In Two Parts—Part One

JANUARY, 1936

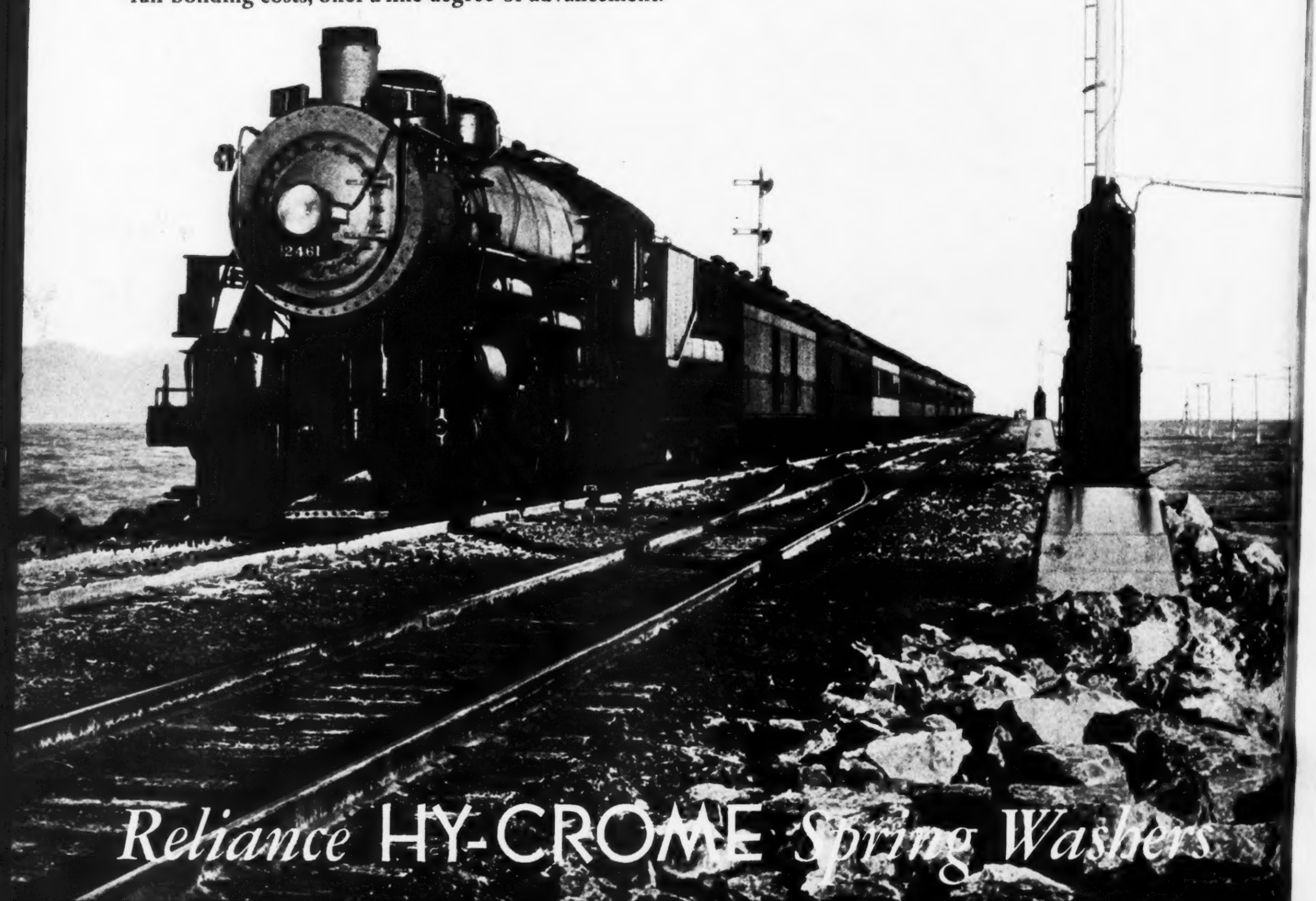
Railway Engineering and Maintenance

One of America's Famous Trains

THE OVERLAND LIMITED

SOUTHERN PACIFIC COMPANY

FIRST of the transcontinental railway lines to be completed, in May 1869, the SOUTHERN PACIFIC's run between San Francisco and Chicago today requires only slightly less than 59 hours! Here is the OVERLAND LIMITED crossing the Great Salt Lake over the famous Lucin Cut-off, the double-tracked steel highway over the north American "dead sea". A far cry back to that historic *first* cross-country "express"— this modern train with observation-parlor car, ladies' lounge, maid and valet services, barber shop and shower baths. This famous train and four others of the SOUTHERN PACIFIC are now completely air-conditioned. Comparable with the progress shown between old and new railroad equipment, the A•RE*Active* HY-CROME *Spring Washer,* cutting joint maintenance costs, and the *BONDING* HY-CROME *Spring Washer,* reducing rail bonding costs, offer a like degree of advancement.



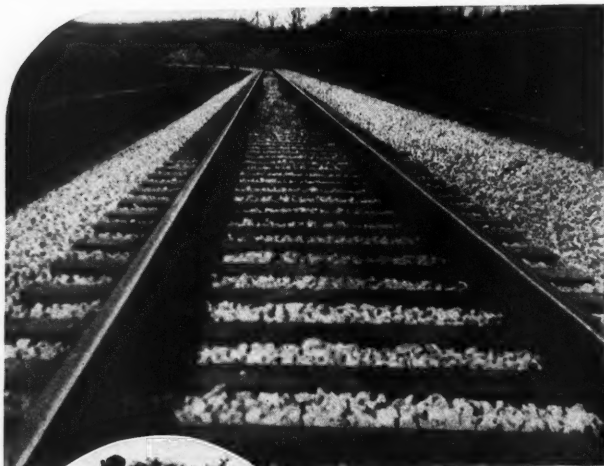
•REActive Deflected	THACKERAY	HY-REACTION	STANDARD	HEAVY DUTY	DOUBLE	BONDIN
eets A. R. E. A. Spec.	For screw spike use	For track bolts	For general use	For frogs—crossings	For special use	Used as rail

EATON MANUFACTURING CO. RELIANCE SPRING WASHER DIVISION, MASSILLON, OH

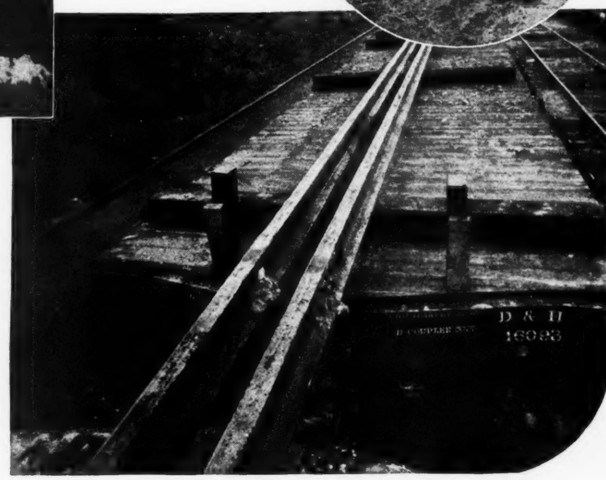
St. Louis • San Francisco • Montreal

Published monthly by Simmons-Boardman Publishing Company, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

TWO MORE ROADS INSTALL LONG WELDED RAILS



← Not a rail joint in sight in this mile-long stretch of track with GEO construction on the B. & L. E.



→ Lack of room prevented working along the right of way on D. & H. at Schenectady, N. Y. So, rails were welded into 700 ft. lengths on cars in a freight yard five miles away. The cars were then hauled to the site of installation, and the long rails unloaded, placed in track and welded together to make up 5000 and 7000 ft. stretches.

B. & L. E. and SOUTHERN

join D. & H. in pioneering the elimination of rail joints

Interest in continuous rails is growing by leaps and bounds. Important railroads throughout the country are becoming convinced both of the tremendous savings made possible by the elimination of rail joints and of the feasibility of welding rails into long jointless stretches.

This year, two more roads joined the ranks of the pioneers in welded track. The Bessemer and Lake Erie put in a mile of single track with GEO construction at River Valley, Pa. The Southern Railway welded the track in a 1300 ft. tunnel at Missionary Ridge, Tenn. And, the Delaware & Hudson, continuing the work started two years ago, placed in service two more installations with M. & L. construction. One of these, at Schenectady, N. Y., included one stretch of single track approximately 5000 ft. long, joined by insulated joints to another stretch more than 7000 ft. long. The second D. & H. job, at Windsor, N. Y., consisted of four mile-long continuous rails.

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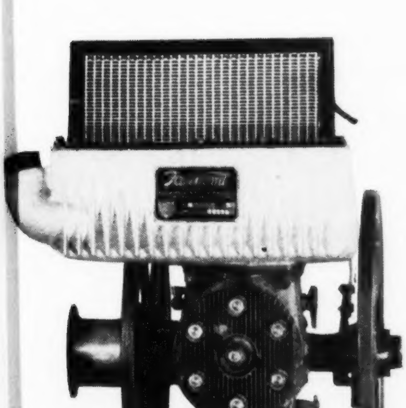

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(5-8 H.P.) Engine, noted for its consistent delivery of surplus power.

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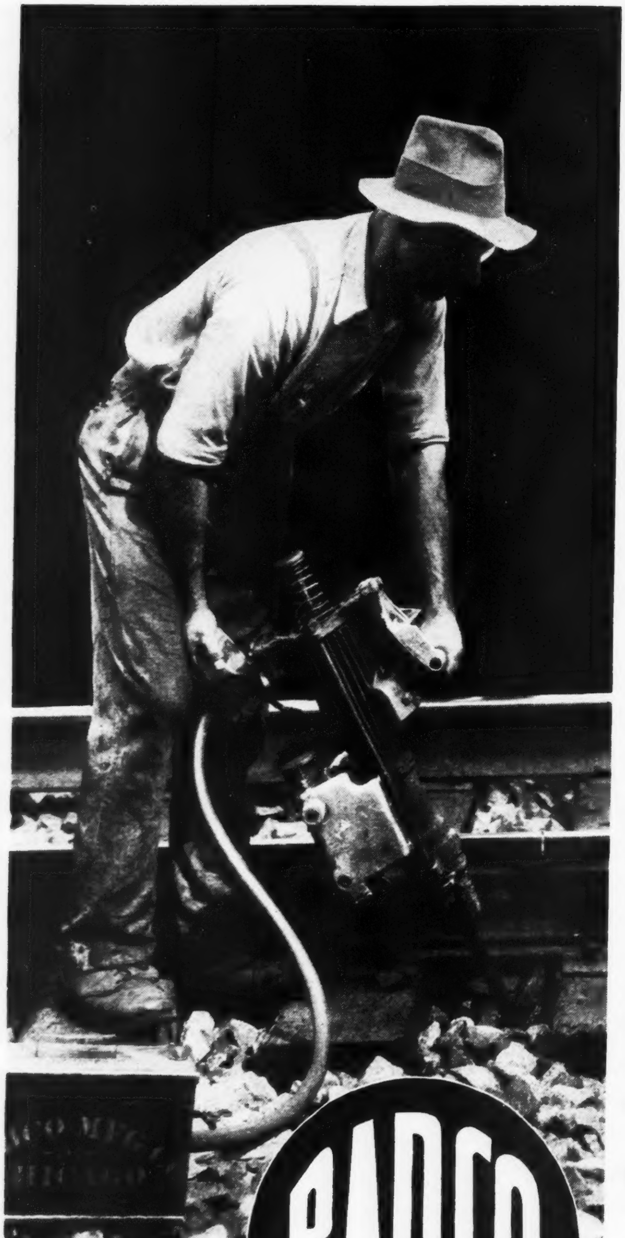

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The Barco Unit Tytampers may be used singly or in units of 2, 4, 8, 12, 20 or more without requiring any extra or special equipment of any kind, or may be used individually for spot tamping and maintenance.

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The Barco Unit Tytamper is recommended for tamping, where large gangs are used, or for spot tamping on line of road, or around terminals where train movements are heavy.

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Published on the last Thursday preceding the month of issue by the

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D. C.
932 National Press Bldg.

SAN FRANCISCO
55 New Montgomery Street

Subscription price in the United States and Possessions, 1 year, $2.00, 2 years $3.00; Canada, including duty, 1 year, $2.50, 2 years, $4.00; foreign countries, 1 year, $3.00, 2 years, $5.00. Single copies, 35 cents each.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.)

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

January, 1936

1935

A Year of Many Changes

THE year that has just closed was one of many and varied characteristics. It was the fifth year of drastic curtailment of expenditures for maintenance of way, while improvement work was at a standstill. Yet it witnessed the inauguration of passenger service by several roads on the fastest schedules ever established on this continent for distances upward of 200 miles and the reduction of the schedules of many other trains, freight as well as passenger, throughout the country. Dust storms and floods assumed proportions of major catastrophes in widely separated areas, drawing heavily on already depleted funds for maintenance. The search for still more efficient organizations for maintenance led to the further reorganization of forces and methods of working on several roads, most revolutionary of which was the elimination of the time-honored section gang by one major system. All in all, the year was characterized by a series of major developments of far-reaching importance, with indications of still further changes of equally revolutionary nature during the present year.

The Year's Record

The year's railway record may be summarized briefly as follows:

Freight traffic increased 4.6 per cent over 1934 and 12.8 per cent over 1933.

Passenger traffic increased 2.0 per cent over 1934 and 12.6 per cent over 1933.

Operating revenues increased 5.1 per cent over 1934. Operating expenses increased 5.4 per cent.

Net railway operating income approximated $500,000,000 in 1935, an increase of $37,000,000 over 1934, yielding a return on property investment of 1.90 as compared with 1.79 in 1934.

The net deficit after fixed charges is estimated as $15,000,000, as compared with a net deficit in 1934 of nearly $17,000,000.

Turning to operating performance, for the first ten months of the year, the operating ratio was 74.9 as compared with 74.6 in 1934.

The average speed of freight trains between terminals reached a new high of 16.0 miles per hour as compared with 15.9 in 1934 and 13.2 in 1929.

The average movement per "active" freight car (excluding stored or surplus equipment) was 30.3 miles per day, compared with 29.9 miles in the year 1934.

The average freight carload was 25.9 tons, fractionally higher than in 1934. The average freight train load was 731 tons, compared with 709 tons in 1934.

Net ton-miles per freight-car day increased to 413 in 1935 from 380 in 1934. Net ton-miles per freight train hour reached a new high of 11,726 as compared with 11,225 in 1934.

Preliminary information for the first 11 months of 1935 indicate that not a single passenger fatality occurred in a train accident during that period.

While these figures show the results for the year as a whole, they do not convey a full picture of the difficulties that confronted railway managements during the first half year, or the improvement that occurred during the closing months. During the first seven months, revenues remained about the same as in 1934, but mounting expenditures increased the deficit to $80,000,000. As a result, a number of additional railways were forced into the hands of receivers or trustees until 27.8 per cent of the rail mileage of the United States was in this status at the end of the year.

During the closing months of the year, however, conditions improved markedly, with the result that the deficit after fixed charges was reduced to $15,000,000. The trend at the end of the year was distinctly more favorable than at any time since 1929. As a result, the outlook for increased expenditures for the rehabilitation of the fixed properties is now more favorable than it has been at any time since 1930.

Expenditures for Maintenance of Way

Of primary concern to the maintenance of way department are the expenditures for the upkeep of the fixed properties. These expenditures for the last 20 years are as follows:

1916	$ 421,775,812	1926	$866,819,365
1917	442,108,862	1927	868,581,432
1918	649,794,953	1928	837,905,747
1919	772,186,045	1929	855,354,867
1920	1,032,540,381	1930	705,470,940
1921	756,413,690	1931	530,612,890
1922	728,663,534	1932	351,179,041
1923	813,688,760	1933	322,335,022
1924	792,678,023	1934	365,285,353
1925	816,443,205	1935*	399,000,000

*Last two months estimated

These figures reveal the extent of the reduction that has taken place year after year since 1929 until in 1933 the expenditures were only 38 per cent as great as four years previous, while in 1935 they were only 46 per cent as large. The extent of this decline is shown still more strikingly by comparing these expenditures for the four years 1926-29, inclusive, with those for the four years 1932-35. In the earlier period they aver-

aged $857,166,000 per year, while in the latter period this figure was $355,000,000, leaving an average reduction in expenditures of $502,000,000 per year.

Somewhat more encouraging is the fact that 1933 marked the low point in expenditures, with 1934 recording an increase of 13 per cent and 1935 a further increase of 9 per cent. It is pertinent also to note that in every month except four since July, 1933, the roads have spent more for the upkeep of their properties than in the corresponding month of the year previous, and in the four months where decreases were recorded, the declines were small.

Is There Undermaintenance?

In view of this decline in expenditures, the question naturally arises regarding the extent of the deferred maintenance that has accumulated. If one takes the 1926-29 average annual expenditure of $857,166,000, as a basis, the total deficiency now approximates $2,500,000,000 or three years of pre-depression expenditures. This figure is, of course, grossly excessive, for it takes no account of the decreased wear and tear resulting from the smaller traffic, of the almost complete elimination of charges incident to improvement work, of the increased efficiency of labor and the longer life accruing from the investment made in more permanent materials during the 1923-1929 period of widespread improvement, or of the means that have been developed to secure increased efficiency from both labor and materials.

That these factors are of large proportion is evident. The determination of the magnitude of their influence is not, however, capable of accurate calculation. After making what appeared to be ample deductions, we estimated two years ago, however, that the railways would have to spend at least $700,000,000 to restore their fixed properties to the condition that prevailed in 1929. Since that time the roads have not reduced this deficiency but have rather added to it, until it may now be estimated that there is today an accumulated deficiency in maintenance approaching $1,000,000,000.

It is self-evident that every train that passes over the tracks and structures exacts a toll in service life therefrom which, if not replaced in due time, results in a weakening of the structure. Likewise, decay and the elements exact their toll with the passing of the days. To the extent that his deterioration is not made good, the properties suffer.

This situation, while serious, does not necessarily indicate that the railways are approaching a condition of danger. Rather, in large measure this retrenchment has been effected in avenues which do not affect safety of travel, such as the maintenance of buildings. Likewise, it has been evidenced more largely on branch lines of lighter traffic than on high-speed main lines. Also, in many instances, it has been attained through the adoption of equally safe but less economic practices as a means of tiding over until earnings improve sufficiently to warrant larger expenditures.

Rail Replacement

One indication of the state of maintenance of the railways is afforded by the amount of rail relaid. The tonnage of new rails laid in replacement in recent years is as follows:

	New Rails Laid In Replacement		New Rails Laid In Replacement
1923	1,660,000	1929	1,958,489
1924	1,720,000	1930	1,517,002
1925	1,870,000	1931	984,900
1926	2,120,000	1932	394,536
1927	2,124,765	1933	403,254
1928	2,080,277	1934	631,093
		1935 (estimated)	600,000

From these figures it is seen that the replacements with new rail during the period from 1924 to 1929, inclusive, averaged 1,980,000 tons per year. Likewise, the replacements during the six years 1930 to 1935, inclusive, averaged 750,000 tons annually. This is a decline of 1,230,000 tons per year or an accumulated deficiency of more than 7,000,000 tons during the last six years. Such a deficiency is not, of course, in accord with the facts, for it does not take into account the reduced wear resulting from the lighter traffic of the depression years. Neither does it credit the extension in the life of rail resulting from the increased application of heat treatment and welding of the rail ends and other measures with the same objective. Even after making due allowance for these influences, it is evident, however, that it will be necessary to lay at least 3,500,000 to 4,000,000 tons of rails in replacement to obtain the condition of track equivalent to that which prevailed in 1929.

Crosstie Situation

Crosstie renewals afford another measure of the standard of track maintenance, for no track is better than the ties which support its rail. Differing somewhat from rail, in that tie life is affected only in part by traffic and in larger degree by climatic influences, the deterioration is more constant than with rail. A counter influence is the benefit that is accruing from the more widespread treatment of ties, which contribution to increased tie life has been particularly outstanding during the last few years by reason of the greatly increased installation of treated ties during the years preceding 1929.

Crosstie renewals during the last 15 years follow:

1920	86,829,307	1928	77,370,491
1921	86,521,556	1929	74,679,375
1922	86,641,834	1930	63,353,828
1923	84,434,985	1931	51,501,659
1924	83,073,059	1932	39,190,213
1925	82,716,674	1933	37,295,716
1926	80,745,509	1934	43,306,205
1927	78,340,182	1935 (estimated)	46,000,000

As with rail, it is difficult to determine the present deficiency in crosstie replacement with any degree of accuracy. A year ago we estimated that there were then in track 85,000,000 ties that would have been replaced under more normal conditions. Even with the somewhat more liberal renewals that were made in 1935, no progress was made in overcoming this deficiency. In fact, it has probably been increased.

The effect of this more than five years of undermaintenance is difficult to evaluate. If continued indefinitely, it

is self-evident that it can end only in disaster. Whether we are approaching the limit is the subject of wide difference of opinion. There is no one criterion. Neither is there any uniformity in the condition on different roads, let alone different lines on the same road. One indication, and a very general one, is the number of derailments chargeable to defects of roadway and structures, which showed a steady decline until the second half of 1932, and an increase since that time. This change in trend may be of significance. It at least constitutes a note of warning to maintenance officers.

Capital Expenditures

In keeping with maintenance of way expenditures, capital outlays for both roadway and equipment continued at a low level, approximating $225,000,000 during 1935. While this total is larger than for any of the three previous years, it is less than 30 per cent of the annual average for 1923-30. A relatively small proportion of this expenditure went for improvements to roadway and structures, principally grade separation.

While expenditures for the maintenance of roadway and structures increased for the year, the number of employees declined slightly, the average number for the year, with the last month estimated, totaling 205,000, as compared with 208,794 during 1934. The amount of money paid to employees increased, however, by reason of the restoration of the wage reduction.

It is interesting to note that during the four years 1926-1929, inclusive, the annual force averaged 412,777. In 1930, this annual average declined to 349,202, and in 1933 to 198,038. In 1934, however, the total increased to 208,794, with a slight recession in 1935, as indicated above. It may be noted again that for the fifth consecutive year, the *maximum* force in any month has been less than any normal winter force prior to 1930.

Higher Speeds

What was probably the outstanding development of the year for maintenance employees was the inauguration of passenger service at markedly increased speeds between important cities. Between Chicago and St. Paul, between Chicago and the Pacific Coast, between New York and Washington, between Chicago and St. Louis, between New York and Chicago, between Boston and Portland, Me., and between other important centers, trains of streamlined and standard construction, propelled by both Diesel and steam power, were placed in regular service on schedules materially exceeding 60 miles per hour between distant terminals, requiring running speeds in numerous instances up to 100 miles per hour in routine performance.

Ushering in as they do a new era in transportation, the records made by these trains reflect great credit on the roadway department. These schedules have led to extensive rehabilitation of the tracks over which these trains operate and placed more exacting requirements on the routine maintenance of line and surface. They have brought to the front refinements in maintenance not heretofore warranted, especially in the spiraling and superelevation of curves. Announcements made during the closing weeks of the year indicate the further extension of these services in 1936. Nor are these reductions of schedules confined to passenger service, for they are equally numerous in freight service as well.

In striking contrast with the conditions that prevailed during the years immediately preceding, when subnormal rainfall over large areas contributed to the reduction in maintenance costs, 1935 was a year of major disasters in numerous parts of the country. In the spring, the plains areas were swept with a series of dust storms of unprecedented severity, which added greatly to the problems of the maintenance forces, only to be followed within a few weeks by floods that wrought heavy destruction in limited areas. Later in the summer, floods of equally destructive effect were experienced by numerous railways in the east while in September a tropical hurricane destroyed a large part of the Key West extension of the Florida East Coast.

The long continued necessity for retrenchment brought further drastic reorganization of maintenance forces on a number of roads during the year. The tendency towards the transfer of such routine operations as the renewal of ties, surfacing and the tightening of bolts from section gangs to floating gangs organized specifically for this purpose and equipped with the latest machines, received increasing recognition, a number of roads resorting to these methods for the first time. Even more revolutionary was the step taken by the New Haven in eliminating section gangs, as such, and substituting in their place floating gangs without specific territorial responsibility and moved from place to place on the instructions of the supervisor. The changes which have been made to date are evidence that the maintenance of way organization is undergoing searching scrutiny to determine the most efficient means of meeting today's problems with the forces and equipment that are available.

What of 1936?

In spite of the difficulties which surround them, the railways and their maintenance forces enter the new year with a more optimistic outlook than has prevailed since 1929. The recovery in traffic which became manifest late in the summer maintained its momentum into the new year with no influences yet evident to indicate any change in trend. Railway earnings are showing an equally encouraging increase. Since increased expenditures for repair and improvement inevitably follow increased earnings, the indications are that funds will be available in greater amount during 1935 to make good current wear and tear and possibly to undertake some of the work that has been so long deferred.

The new year will see more exacting demands made on maintenance forces by faster schedules. It will, at the same time, demand the continuation of the search for maximum efficiency in order that the maximum results may be secured from the increased funds that are expected to be available.

The Abraham Lincoln—the Alton's New St. Louis-Chicago Train

Alton

THE reconditioning of the rail ends at 76,088 joints in a period of four months during the summer of 1935 was the record established by the Alton when it was confronted with the problem of getting its double-track Chicago-St. Louis line in the proper condition to carry its new high-speed train, the Abraham Lincoln. This work comprised an important element in the program of general improvement of the track; it was started on May 23 and completed on September 20, or four months later.

A statement of the problem presented and of the considerations affecting the solutions adopted, together with a summary of the cost of the welding work as presented below are taken from a paper prepared by Armstrong Chinn, chief engineer of the Alton, which was presented before the International Acetylene Association at Cleveland, Ohio, on November 15. The excerpts from Mr. Chinn's remarks are followed by an account of the organization and methods employed, which was prepared by a member of the staff of *Railway Engineering and Maintenance.*

Preparing for High Speed

As Told by Armstrong Chinn,
Chief Engineer of the Alton

LAST summer the Alton improved its service between Chicago and St. Louis with more comfortable equipment, running on the fastest schedules ever attempted between those cities. The Alton also placed in service its new train, the Abraham Lincoln. The finer equipment and faster schedules necessitated considerable refinement in the track, and an extensive program for improving the riding qualities was started in May and concluded in September. The program, roughly speaking, was divided into five parts; lining and surfacing the tangent track; relining, lengthening the spirals and increasing the elevation of most of the curves; laying some new rail; rearranging a few signals and lengthening the approach sections for most of the automatic highway crossing protection; and welding the rail ends on 245 miles of track.

The work of lining and surfacing the tangent track was a matter of routine maintenance, a little more extensive than usual, perhaps, but carried out in the regular manner. The readjustment of the curves, however, presented several questions that had to be answered before work could be started. There are, counting both tracks, 165 curves between Chicago and St. Louis, of which 137, involving 40 miles of track, required readjustment for the higher speeds. With so many to be taken care of in a limited time, the first thing that had to be determined was the best method to follow so the work could be done quickly.

Then the question of the elevation and the spiral length had to be settled. It would have been a slow and tedious process to have sent out transit parties to run the curves with instruments and it is doughtful if they could have been staked rapidly enough by that method to have prevented delay to the track gangs that were lining and surfacing them. For that reason the string line method, which offered speed and flexibility, was adopted with results even better than anticipated. Two parties of three men each took the preliminary field measurements and sent the notes to five men who calculated the curves.

The next question concerned the elevation to be carried. There is such a difference in speed between the fast passenger trains and the freight trains that to have elevated the curves to equilibrium for the passenger trains would have produced a bad condition for the freight trains. The main objective was comfort for the passengers and as it has been found that a curve elevated to 70 per cent of equilibrium gives a comfortable ride, that figure was adopted on the Alton. A maximum speed of 80 miles per hour was assumed and the elevation was limited to a maximum of 6 in. Elevating the curves to 70 per cent of equilibrium for the maximum speed of 80 miles per hour gave three inches of elevation for one-degree curves and six inches for two-degree curves. Curves sharper than two degrees, located in high-speed territory, were elevated to the maximum of six inches and the speed around them was limited by appropriate slow signs to the maximum permitted by the degree of the curve and the elevation of six inches.

The final problem to be solved was the proper length of spiral. The

n Reconditions 150,000 Rail Ends in Four Months' Time

An extensive rail end repair program, necessitated by the inauguration of high-speed passenger service between Chicago and St. Louis, involved 239 track miles of 90-lb. rail and 6 miles of 100-lb. rail. Large well-organized gangs, together with the use of a fast welding technic resulting in a high output per welder, assured a low average cost per joint welded.

old standard on the Alton was 100 ft. of spiral for each degree of curve, but that was too abrupt for the proposed higher speeds and did not give sufficient length in which to run out the increased elevation. After some study it was concluded that if the elevation was run out at the rate of ½ in. per 39-ft. rail, comfortable riding would be assured. As the spiral and the elevation should run out together, fixing the length of run-off for the elevation also fixed the length of the spiral.

After the curves were adjusted and the new schedules put into effect it was found that the riding qualities were better than anticipated and the results were very satisfactory. The string-line method was used on the Alton during this program for the first time, but it proved so satisfactory and was such a time saver that it has been adopted as standard for all future curve relining. It was just another case of finding a cheaper way of doing something.

There was nothing unusual about the laying of the new rail other than that it was done quickly so as to have the track ready in time for the faster schedules.

Rail End Welding

The final part of the program, and probably the most interesting, was the building up of the battered rail ends by the oxy-acetylene process. There was, in both mains, 245 track miles of rail which, while not worn out by any means, was battered at the ends sufficiently to affect the riding and maintenance of the track. The purpose of the whole program was to make the track ride better, and to get the desired results something had to be done with the rail. Surfacing the track, and tamping and tightening the joints was not enough, as that could not replace the missing metal. Replacement with new rail was out of the question, because of the tremendous expense that would be involved and because there was no reason to replace rail that was entirely good except for the battered ends. With the battered ends restored the rail would ride approximately like new rail and would be satisfactory for some time to come. Knowing what the difficulty was, the solution was easy. Accordingly, an extensive program for building up the battered rail ends was in order. The Oxweld Railroad Service Company, which has the welding contract on the Alton, was called upon to function in the same capacity with respect to the additional work.

How the Welding Was Done

By M. H. Dick
Associate Editor
Railway Engineering and Maintenance

PREPARATORY to the welding operation, the joints to be reconditioned were tamped out-of-face, loose bolts were tightened and American Fork & Hoe Company shims were applied wherever sufficient wear of the joint bar and the underside of the head of the rail had taken place to allow the bar to come into contact with the web of the rail. Some of the more badly worn bars were replaced with new bars. This preliminary work, which was carried out largely by the regular section forces but to some extent by extra gangs, was so scheduled as to give the joints several weeks in which to become properly seated.

The welding work itself was of special interest because of the broad scope of the operations, the highly efficient type of welding organization employed and the welding technic used, which was not only found to be fast but was productive of welds that compare in hardness with heat-treated metal.

The welding forces consisted of two gangs of similar organization, containing 33 men each which were so organized as to relieve the welders of all duties and responsibilities except the actual welding of the rail ends, all work in connection with the moving of the cylinders, hose and other material, the changing of connections, etc., being handled by less expensive labor.

Each of the welding gangs was comprised of an extra-gang foreman, an assistant extra-gang foreman, 8 welders, 4 welder helpers, 2 slotter operators, 2 grinder operators, 5 grinder helpers, 7 track laborers, a timekeeper, a water boy and a night watchman. As first organized, the gangs contained 10

1. Welder Helper With a Straight Edge Marking the Length of a Weld

2. Beginning the Application of a Weld

3. Hammering the Newly Applied Weld Metal

welders each but as these men became proficient in the use of the welding technic employed, it was found that the two surface grinders used could not keep up with them; therefore, the number of welders in each welding gang was reduced to eight.

In addition to the above-named personnel, each gang had the services of a welding supervisor furnished by the Oxweld Railroad Service Company, which company supervised the organization of the gangs, recruited and trained the welders, and furnished all materials and the necessary surface grinding and slotting machines. The welding supervisors, while directing their attention particularly to the activities of the welders with a view to obtaining the desired quality and type of welds, also assisted in the supervision of the welding operations as a whole. The equipment used by each gang, in addition to the necessary welding outfits, included a Nordberg surface grinder, a Northwestern Motor Company surface grinder and a Nordberg slotting machine.

Duties of Gang Personnel

While the extra-gang foreman exercised general supervision over the activities of the gang as a whole, most of his time was spent in supervising the work of five laborers engaged in distributing cylinders of welding gases to set-ups in advance of the welders and in disposing of the empty cylinders. As the usual hose length of 100 ft. was used, 10 joints were reached from each set-up where the rail was 33 ft. long and the gas cylinders, including one cylinder of oxygen and two of acetylene, were spotted between the fifth and sixth joints. Where the rails were 40 ft. long, each set-up included 9 joints and the cylinders were spotted opposite the fifth joint.

All material and devices included in the individual welding outfits, such as the hose, the blowpipe, the oxygen and acetylene regulators, and the acetylene manifold, were transferred from finished set-ups to new set-ups by one of the helpers. To facilitate the transportation of this material, this helper was provided with a small hand car of the velocipede type which could be operated on the second track without interfering with the welding operations. The policy of assembling complete welding outfits in advance required the provision of 12 such outfits in order to provide a margin of idle equipment which would be free for movement.

Another welder helper dismantled the outfits at completed set-ups and arranged them in convenient form to be moved forward, while a third helper assembled the outfits at new set-ups in complete readiness for the welders. The latter helper was also provided with a straight-edge and assigned the task of marking the lengths of the welds. In this step the limits of the weld were indicated by yellow crayon marks on the side of the rail head, while the number of the welder and the length of the weld in inches were marked on the base of the rail in the same manner. The fourth welder helper spent all his time among the welders, changing connections from empty to full cylinders, distributing welding rods, acting as a lookout for trains, and keeping a record of the number of lineal inches of welds made and the number of cubic feet of oxygen and acetylene used by each welder.

The slotting machine, operated by two men, followed immediately behind the welders. With this machine, which was fitted with a ⅛-in. grinding wheel, the rail ends were slotted to a depth of not less than ¼ in., and were given a slight bevel. In order to preclude the possibility of the welds becoming chipped, the joints were slotted as quickly as possible after the completion of the weld. In the operation of the surface grinders, each operator was assisted by two helpers, while the fifth grinder helper relieved the other helpers from time to time, in addition to keeping a record of the number of joints ground and acting as a lookout for trains.

Insulated Joints

The main body of the welding organization included seven welders while the eighth welder, aided by the assistant extra gang foreman and two track laborers, welded the rail ends at insulated joints in advance of the other operations. In this work, in order to preserve the insulation, standard angle bars were substituted for the insulated joints while the rail ends were built up, the work of changing out the bars being done by the two laborers. The rail ends at all other joints within the reach of the set-up at each insulated joint were also built up at the same time, although they were not slotted and surface ground until the arrival of the main welding gang.

When working in territory where the rail ends in both tracks were to be reconditioned, the welding was alternated between the two tracks, being carried out in stretches six miles long which were staggered

with respect to each other in order to reduce the distance that the outfit must be moved back when changing from one track to the other. When beginning new stretches, the fastest welders were put to work on the first set-ups in order to lose as little time as possible in getting the slotters and the grinders started. All freight, extra and local passenger trains were operated through the welding gangs under slow orders, while the track was required to be clear for through passenger trains.

Reason for Two Gangs

The choice of the welding organization employed was influenced in part by a somewhat peculiar circumstance. Originally it was the intention to have four welding gangs of equal size, but since sufficient camp car equipment was not available to outfit more than two separate gangs, it was decided to consolidate the four outfits originally contemplated into two gangs having the same number of welders as would have been used in the four gangs. Not only did there appear to be no objections to this plan but with the larger gangs a smaller number of auxiliary employees per welder was required than in the gang organization originally contemplated, thus resulting in a substantial saving in labor and a lower cost per joint.

In addition to the reduction in the cost of supervision that was effected through the consolidation of two gangs into one, retaining the same number of welders, it was possible to eliminate three track laborers, a time keeper, a night watchman, a water boy, a grinder helper and two slotting machine operators. The elimination of the slotting machine operators reflects the fact that one slotting machine was found to be sufficient to do all the slotting for each of the enlarged gangs. Thus, by consolidating the gangs it was possible to effect a saving in labor costs equivalent to the wages of 13 employees for each of the enlarged gangs, or a total of 26 employees for the entire welding organization.

The Welding Technic

The method of applying the metal to the rail ends that was employed by the welders on this job is known as the "straight-line" method, this designation being derived from the fact that the metal is applied progressively in a direction away from the welder in patches having a width approximately one-half that of the rail head. In this method the length

(Continued on next page)

4. Slotting the Joints with a Nordberg Slotting Machine

5. The Welds Were Finished by Grinding—The Nordberg Grinder in Operation

6. Grinding Joints with the Northwestern Grinder

of the strip over which the welder may apply metal without stopping is governed by the fact that after the patch has attained a certain length, usually nearly twice the width of the rail, the welder must stop and shape the weld with a peening hammer before the metal at the beginning of the patch becomes too cool. It is stated that the use of this mehod increases the output per welder and decreases the consumption of gases, with a consequent lowering in the cost per joint.

Another advantage claimed for the straight-line method is that it produces a harder rail end. This is explained by the fact that, owing to the shorter time required to complete the weld, less heat is absorbed by the interior of the rail with the result that the cooling of the weld is rapid, being somewhat analagous to a quenching process. As a result, while the average hardness of the rail ends on the Alton before being welded was 277 on the Brinnel scale, the average hardness of the reconditioned rail ends is 366.

In the application of the straight-line process, the weld patches range in length from about 3 in. to 4½ in., depending somewhat on the total length of the weld. Where there is no expansion gap the patches are usually made continuous between the rails; otherwise the battered area at the end of the leaving rail, which averaged about 1½ in. in length on the Alton, is welded in one patch extending entirely across the top of the rail. When commencing a weld, the first patch is generally placed on the gage side of the rail and, while some welders will place successive patches on the one side for the entire length of the batter before turning their attention to the other side, others will place patches on alternating sides of the rail as they proceed.

Welding Figures

The average length of the welds for the 76,088 joints welded was 6-1/3 in. and an average of 2½ ounces of welding rod were applied per joint. The average output per day per welder was 48 joints, or 304 lineal inches of reconditioned rail, and the average consumption of gases per joint was 8-2/3 cu. ft. of oxygen and 9½ cu. ft. of acetylene. The average cost per joint was 77.4 cents.

This work was carried out under the general direction of Armstrong Chinn, chief engineer of the Alton, while L. C. Ryan, general welding supervisor of the Oxweld Railroad Service Company, directed the work for that company.

Welding in Bridge Work*

By A. R. WILSON

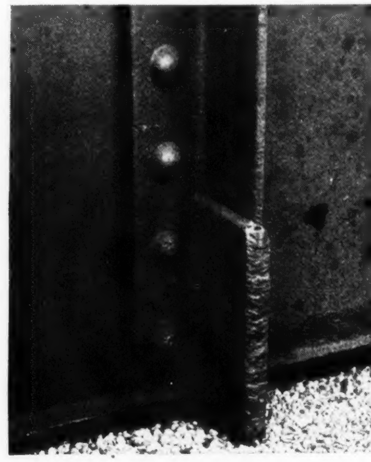
Engineer of Bridges and Buildings, Pennsylvania, Eastern Region, Philadelphia, Pa.

IT HAS been difficult to overcome the natural prejudice that is always engendered by the introduction of a comparatively new method of construction. With welding this prejudice is greater because of unsatisfactory results obtained before welding processes were placed under engineering control.

The main obstacle that welding had to overcome in the early stages of its development was to prove that the deposited metal was sound and of good physical properties and that the work of welders could be relied upon. Ample reassurance on both of these points has now been furnished, an outstanding contribution being the 1931 report of the Structural Steel Welding committee of the American Bureau of Welding.

Welded bridge construction may be considered historically to date from 1922, when some small experimental structures were built in Belgium. The first important bridges fabricated by welding in the United States were constructed in 1927 by the Westinghouse Company for rail road service on its own lines. Since that time, and up to the present year, no important all-welded bridge structures have been erected in this country. During the past summer the American Bridge Company completed at Delanco, N.J., an all-welded highway draw bridge, with fixed approach spans, with a total length of 400 ft., and a total tonnage of 450, and requiring 24,000 lin. ft. of welding.

In 1933 the State Highway Commission of Kansas prepared an all-welded design for the Fairfax viaduct, Kansas City, Kan. Bids were received for two alternate designs, one all-welded and the other with riveted construction for the main girders; the contract was let with the provision for riveting the main girders, the bids being substantially the same for both types of construction, although the welded design



Corroded Stiffener Repaired by Welding

showed a 15 per cent saving in weight.

In Europe, Poland, Czecho-Slovakia and Belgium led the way in early all-welded bridges, being followed by the other countries; at the present time Germany and Belgium are the most active. In Germany alone it is reported that the State Railways will have 100 welded plate-girder bridges in service this year; likewise Germany has been the greatest contributor to the engineering research, all of the interests in that country—the railways, shipyards, government and the university laboratories having combined to attack these problems by co-ordinated research with fruitful results.

Special Problems Involved

Welding introduces special problems of its own in bridge construction as compared with buildings, in that bridges involve more varied forms and sizes of structures and necessitates more detailed design, the most important difference being that bridges must carry repeated and impact loads which occur only to a subordinate degree in buildings. I would be surprised if among the present generation of railway bridge engineers, there would be one who would have the temerity to design and build an all-welded bridge to

*Abstracted from a paper presented before the convention of the American Railway Bridge & Building Association on October 16.

carry railroad loads, although there are now in the course of preparation, by a committee sponsored by the American Welding Society, specifications covering the design and fabrication for all-welded bridges, both railroad and highway.

The problem of maintenance is one that should be uppermost in the minds of the bridge engineer, both in the design of new structures and in prolonging the life of existing structures. The effects of corrosion and the increase in the weight of equipment are two of his greatest nightmares, and when he is confronted with a structure, the useful life of which has expired only in part, he must by some method repair or strengthen it so that it may be continued in service.

Welding will not solve all of our problems, but many do arise for which no other method is so well adapted, and I am convinced that by welding, repairs and strengthening can be done both safely and economically. Welding derives its advantage over riveting in the reinforcement of old structures from the fact that it provides a means of attaching new metal without the use of rivets or bolts. Welding obviates the temporary weakening of members sometimes caused by removing

Building Up Corroded Rivet Heads

rivets or drilling new holes, and thus avoids delays to train service by reason of slow orders or temporary interruptions of traffic. This makes it possible to carry on reinforcing work of a character that would not be attempted by riveting, because of the expensive dismantling or falsework that would be required.

Reducing Ditching Costs

By using the crews of local freight trains to operate its spreaders, the Minneapolis & St. Louis has effected substantial savings as compared with the cost of work train service

SUBSTANTIAL economies in the cost of doing ditching and embankment widening work have been effected by the Minneapolis & St. Louis under an arrangement whereby the crews of local freight trains operate Jordan spreaders during periods of the day that represent the difference between eight hours and the time spent by the crews on their regular runs. In other words, the railroad merely utilizes the time of train service employees that is paid for under the rule that eight hours or less comprise a day's work but from which it otherwise would obtain no benefit. Under this arrangement, the only out-of-pocket expenses chargeable to the ditching work are those for fuel and supplies for the engine, which are computed on a pro-rata basis, and wages paid to the train crew for overtime incurred in the operation of the spreader, although the purpose is to reduce the overtime to a minimum.

Because of the absence of the necessity of paying wages to the train crews for the full time that they devote to the ditching work, the cost of ditching under this plan, is much less than when the work is done by work train. In one typical season, local train crews ditched or widened embankments on 130.58 miles of line at a total out-of-pocket cost of $1,604.08, or $12.28 per mile. In the same year, the out-of-pocket cost in connection with the operation of a spreader by work train over 32.06 miles of line was $2,334.27, or $72.98 per mile. The plan has not been confined to ditching and bank-widening but has been applied to all classes of work that otherwise would require the services of a work train, such as the unloading or loading of ballast, rail, bridge material, culvert pipe and ties.

The Minneapolis & St. Louis has two spreaders that are operated under this plan. As a rule, the work is done out-of-face and includes the ditching of the cuts and the widening of the embankment at the ends of the cuts with the material obtained from the cut ditches.

The work is supervised by the track supervisors, who, when the plan was first adopted, also operated the spreaders. However, as the plan gained in favor and came into more general application, the track foremen were taught to operate the spreaders and the supervisors were relieved of this phase of the work. As a rule, each foreman operates the spreaders when it is working on his territory, but if for any reason it is impracticable to follow this plan, a foreman from an adjacent section operates the machine. By using the foremen for this work, the necessity is avoided of assigning a regular operator to this class of service for only two or three hours a day.

The amount of time that a train crew can devote to the ditching work in any one day depends on the schedule of the train to which it is assigned. If the run, for example, requires six hours, the crew may operate a spreader two hours before any overtime is incurred. When the train crew has spent the permissible amount of time with the spreader, it sets the machine out on the nearest siding or where it can be picked up most conveniently on the next trip, and proceeds with its run.

Because of the increased expense involved when a train crew works overtime on the ditching work, an effort is made to incur as little overtime as possible. Frequently, however, it is deemed desirable to work overtime in order to complete the ditching of a particular cut or for the purpose of placing the spreader at a point where it can be picked up conveniently on the next trip. In the season referred to the two spreaders were operated a total of 197 hr. 30 min. by local train crews, of which 123 hr. 55 min. was overtime. In that year, the spreaders worked an average of 2 hr. 4 min. per day.

With work trains being employed to a limited extent only, all cuts have been ditched out-of-face between Mason City, Iowa, and Eldora, 61 miles, and between Marshalltown, Iowa, and Albia, 81 miles. In addition, extensive ditching work has been carried out between Monmouth, Ill., and Bartlett, and on the Montezuma, Newton and Algona branches.

Practical considerations have prohibited the application of this plan to the entire railroad and, therefore, some ditching is still done by work train. That this mileage is limited, however, is revealed by the fact that the spreaders were operated by work train on only 20 per cent of the total

(Continued on page 33)

The End Section of a Five-Panel Slide Fence on the Conemaugh Division which Employs Plug-Type Circuit Breakers

Taking the Danger Out of Slides

After having used various designs of fences to warn trains of rock, ice or soil movements which might endanger train operation, the Pennsylvania has developed a new type of fence which offers a number of advantages over earlier designs. It is constructed close to the tracks where it can be inspected and maintained readily, and it can be built to any length or height desired. Records of operation indicate its effectiveness and reliability.

FROM a number of years experience in the construction of special fences, linked electrically with the roadway signals to detect and warn of rock falls or earth slides which might interfere with or endanger train operation, the Pennsylvania has developed a design which is relatively simple and economical, and which has proved highly effective under varying conditions. Furthermore, the new type fence is adapted for installation directly alongside the tracks where it can readily be inspected, adjusted and repaired, and it is of such design that it can easily be lengthened or increased in height as conditions may require.

In this latest design, ordinary farm fencing is placed vertically, panel above panel, on suitable poles to afford a yielding entercepter of rocks, ice or soil which might fall from cliffs or hillsides towards the tracks. Supported by messenger wire between poles, each of the vertical panels is fitted with circuit breakers at intervals, which open when any appreciable pressure is exerted against the fence. The opening of any of the circuit breakers automatically opens a line relay in the signal circuit, which, in turn, causes the signals immediately each way from the section of fence affected to assume their most restrictive aspect. Thus, for 24 hours a day, positive warning is given to all trains through the regular wayside signals of any rock fall or slide condition which might endanger normal train movements.

Advantages

Confronted with many unstable rock cuts and rock cliffs along its lines in mountainous districts, the Pennsylvania has for years employed special watchmen and various types of indicating or intercepting fences to safeguard train operation. All of the fences used heretofore, however, have been only a single panel high, usually four feet, or a succession of such fences up the sliping face of the cut or hillside. These fences have proved effective where they could be installed at strategic points, but in many cases involving bluffs or cliffs, or even precipitous slopes, they were extremely difficult to install and often only partially effective. Furthermore, being scattered back up the slopes, frequently covered in part with vegetation, these fences could not always be inspected readily from the track to ascertain any conditions which might have caused signal operation, and, under the most favorable conditions, were usually difficult of access for adjustment, maintenance and for clearing.

In the type now being installed, the fences are generally constructed

directly alongside the tracks, and can be built to any height desired. Of proper height, and carried close enough to the ground, they insure positive interception of rocks from the higher as well as lower levels. At the same time, being erected directly adjacent to the tracks, they make possible rapid thorough inspection, adjustment or repair. As a matter of fact, the cause of any fence operation of the signals can be determined while traveling past the fence at reasonable speed on a track motor car. Even if the size of a rock fall does not indicate clearly whether it is the cause of a restrictive signal indication, all of the circuit breakers in the fence are at such close range that a glance discloses whether any of them have been operated.

Already the Pennsylvania has made more than 16 installations of the new type of protection fence. These range from 1 to 7 panels in height and in lengths up to 3,000 ft.

Poles

As already indicated, the new type of fence employs essentially suitable poles, farm fencing, messenger wire and circuit breakers. In addition, however, it employs various pole fastenings and guys, wire spreader bars, and coil tension springs to keep the wire taut. The poles in most of the installations are of treated timber of the proper height, standard telephone and signal line poles being used for the higher fences. As a matter of fact, at certain locations, the fences have been erected on the poles of existing telephone and signal lines, and in at least one location where a long high fence was required, an existing transmission pole line was shifted to the opposite side of the tracks in order that it might serve also to carry the protection fence. At several locations, worn rails have been used as poles to support the fence, these being set in suitable footings. One of the highest fences on the road employs rail-type poles.

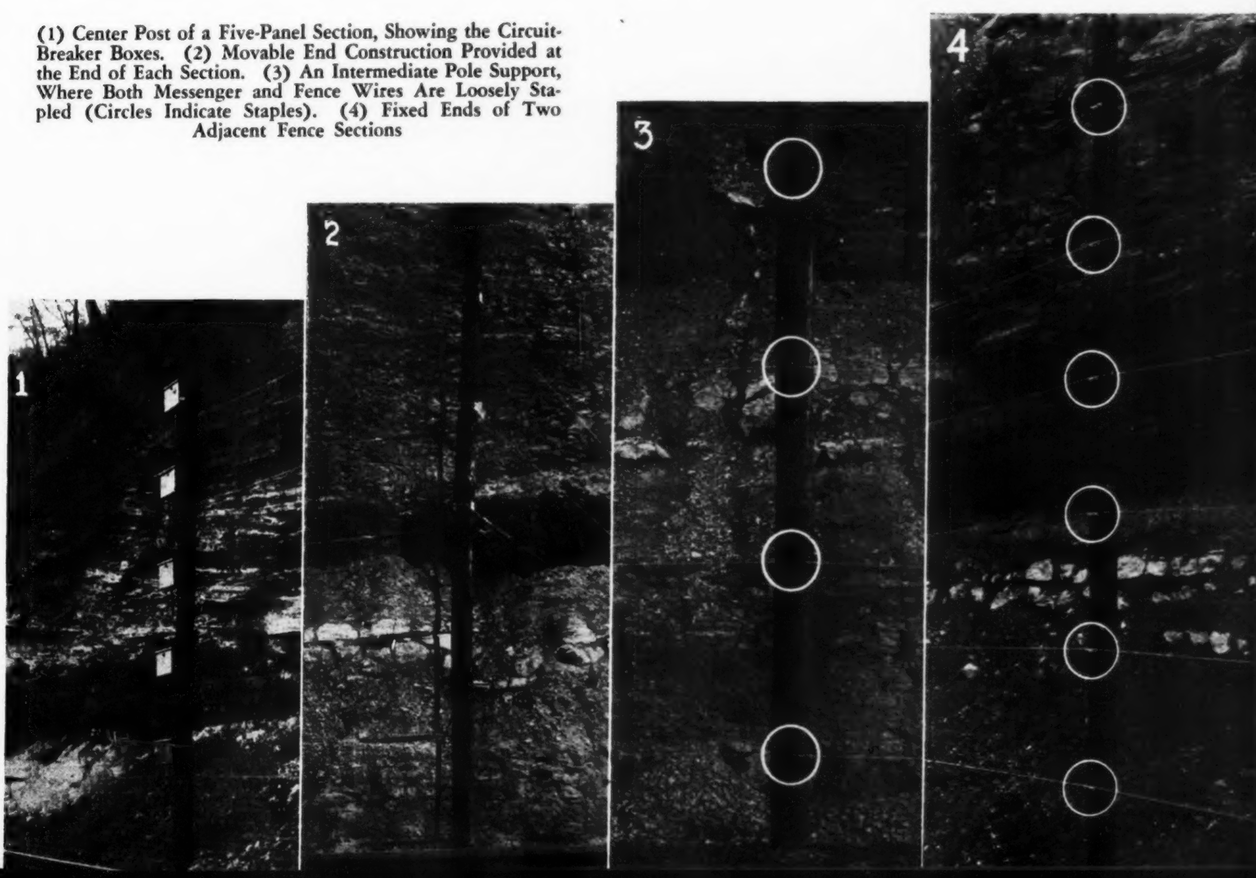
Regardless of the length or height of the fences, they follow the same general design in that while they may be continuous for any number of feet, they are all constructed in operating sections of 450 ft. or less, each section having one fixed end and one moveable end, and either one or three intermediate supporting posts to which the fence wire is stapled loosely. The circuit breaker or breakers are located on the center post of a section, and are so connected with the fence wire that as little as 1½ in. movement of the wire in a longitudinal direction, causes them to operate. In fences more than one panel high, each upper panel is a duplicate of the lowest panel, except that a common messenger wire is used between adjacent panels to support the fencing in the lower panel and to hold the wire in the higher panel in a vertical plane.

Fence Details

The fence wire employed is usually of the woven "hog-tight" type, 4 ft. high, with smaller openings vertically at the bottom, while the messenger wire is ordinary steel strand galvanized pole line messenger wire 5/16 in. or ⅜ in. in diameter. The fencing is held loosely on the messenger wires, top and bottom, by double rings of No. 8 gage galvanized wire, in alternate mesh openings, those along the top being staggered with those at the bottom.

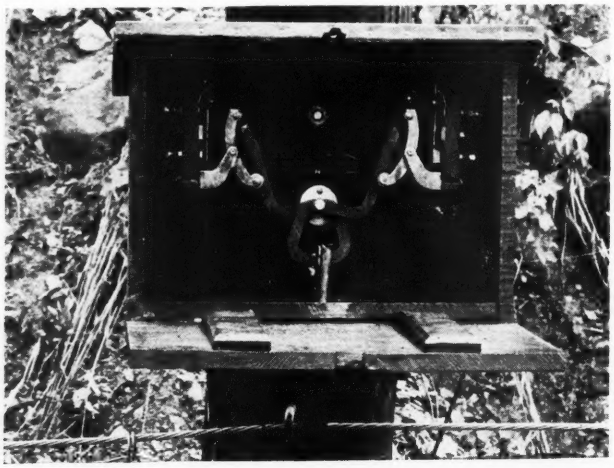
Application of these ring ties is accomplished by first coiling a continuous strand of wire around a 1½ in. bar to form a coil about 18 in. in length, and then nicking the wire with a chisel so that it can be broken readily into two-ring coils. While still a part of the long coil, each two-ring segment is twisted into position about the messenger and fence wire, and it is broken off only after it is in place. This method, which permits applying the individual wire ties in a fraction of a minute, was developed as the result of the difficulty and time lost in the initial in-

(1) Center Post of a Five-Panel Section, Showing the Circuit-Breaker Boxes. (2) Movable End Construction Provided at the End of Each Section. (3) An Intermediate Pole Support, Where Both Messenger and Fence Wires Are Loosely Stapled (Circles Indicate Staples). (4) Fixed Ends of Two Adjacent Fence Sections



stallations in attempting to twist the double rings separately at the various tying points.

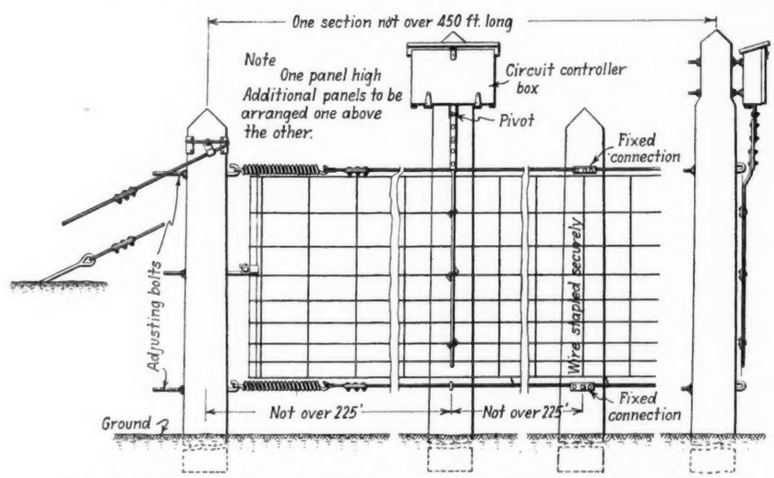
At the fixed end of each fence section, whether by itself or a part of a longer continuous fence, the messenger wires, top and bottom, are attached rigidly to hook bolts, the long threaded ends of which are made to extend through and for 8 to 10 in. beyond the opposite side of the pole. At the opposite, or movable end of each section, the construction is the same, except that a stout coil spring, about 18 in. long, is introduced between the wire and the hook bolt. By adjustment of the nuts on the hook bolts at the two ends of a section, the wire-carrying messengers can be drawn taut, and at the same time possess a degree of lateral flexibility.


Close-Up View of One of the Lever-Type Breakers Being Employed in the Special Circuit

To increase the sensitiveness of certain of the fences, springs have been provided at both ends of the messenger wires in each section, but this has not been found necessary generally, the one-end arrangement providing all of the flexibility necessary under ordinary conditions.

The wire fencing in each section is fixed rigidly at both ends, either directly to the pole by staples, or through a spreader bar or pipe to which the wire is secured, which, in turn, is attached to the pole by means of a clip and a through, tension-adjusting bolt. In the earlier installations of the new type of fence, the ends of the fencing in each section were given a spring connection to the posts, more or less similar to the spring messenger connections, but this arrangement was given up when it was found that there was ample flexibility in the fencing itself, through the slight sag that is inevitable in the long spans employed, to permit sufficient longitudinal movement of the wire at the center of the section to operate the circuit breakers.

A spreader bar is always provided at one end of each individual fence section to provide a means of ready take-up to compensate for any stretching of the fencing, and also so that the fencing can be taken down readily to permit routine ditching or the clearing away of slide material with cranes or ditchers. This latter feature is common to the messenger wires, which, through the adjusting bolts at the ends of each section, can be taken down readily, where necessary, to permit ditching operations.



Details of Construction of Rock Slide Detector Fence One Panel High

At the intermediate poles in each section, where both the messenger wires and the strands of the fencing wire are stapled loosely to the poles, permitting unrestricted longitudinal movement of the wire with the bulging of it at any point, it is necessary to withdraw the staples to take the fencing down for major ditching or clearing operations. With the staples only partially driven, however, this is a simple operation, which, in any event, need be done only at infrequent intervals.

Circuit Breakers

Two types of circuit breakers have been used in the slide fence installations; one, a simple plug-type of cut-out, which, when pulled apart, opens the circuit, and the other, a lever-type device, which, with longitudinal movement of the fence wire, effects the same results. The plug-type breakers were used in the earliest of the new fence installations. However, in the more recent installations they have given way in large measure to the lever-type breakers. This was brought about by fear that through long exposure to the weather, the plug-type breakers might corrode sufficiently to cause the prongs to bind in the receptacle, increasing the pull necessary to effect the break, if not precluding the break altogether under certain conditions.

In single-panel fences, the plug-type circuit breakers are located on each side of the center post of the fence section, mid-way the height of the fence wire. The receptical of each breaker is fixed rigidly to the post, while the plug is wired securely to the fencing. To insure transmission to the plug of a pull on any part of the fencing wire across its face, the plug connection to the fencing is made by means of wire ties extending at 45 deg. to the highest and lowest strands of the fencing, and wired securely to each of the intermediate horizontal strands

crossed. Through this arrangement, a bulge of any part of the fencing transmits a direct pull on the centrally-located plug, even though it may not effect a pull on the fencing wire as a whole.

In installations two or more panels in height, it has been found that a single plug-type breaker, placed between panels, can be made to respond to the action of both panels by giving the plug ties diagonally to all of the horizontal strands in both panels. Thus, this arrangement has been followed wherever panels can be grouped in pairs, any odd panel being treated individually as a single panel.

Housed in Wooden Box

The circuit breaker now being employed generally in the newer installations, is essentially a simple group of pivot bars and electrical contacts such as is used in a switch circuit controller, but actuated by two specially-designed trip levers, so arranged that movement of the lower extremities of either of the two levers of as little as ¼ in. will break the electrical circuit. This type of breaker, one of which is provided for each panel of fencing in each fence section, is housed in a wooden box with a bottom-hinged face cover, so that it can be exposed readily for inspection and for resetting in case of operation.

The boxed-in instrument is located on the center pole in each fence section, directly above the panel of fencing it serves, and is connected to the fence wire by means of a short flat pivoted bar, bolted to a steel rod which is clipped securely in a vertical position to various horizontal strands of the fencing. Through this arrangement, any longitudinal movement of the fence wire transmits a movement to one or the other of the operating levers of the circuit breaker, a movement of approximately 1½ in. of the wire being sufficient to open the signal circuit.

A feature of the lever-type breakers is that an effective operation of the device, that is, an operation sufficient to open the signal circuit, causes an indicating rod, the bottom part of which is painted white, to drop to a position where it projects through the bottom of the box housing. Thus, any of the breakers which have been operated can be detected from the track level.

Where a signal circuit pole line is used to support the slide detection fencing, the wires of the signal circuit are brought down the poles at the circuit breaker locations and are connected through the individual circuit breakers. Where the fencing is on the same side of the right-of-way as the signal circuit pole line, but on separate poles, overhead signal line connections are made to the tops of the circuit breaker poles and are then carried down through the individual circuit breakers. Where, on the other hand, the signal pole

A Five-Panel High Fence Along a Bluff on the Conemaugh Division

line is on the opposite side of the tracks from the slide fence, connection to the fence is made through parkway cable carried beneath the tracks, and supplemental signal circuit wires are run from pole to pole along the top of the fence and through the circuit breakers.

Relocation of Signals

In only a few instances has it been necessary to relocate existing roadside signals to provide full protection to trains through the slide fence areas. In certain instances, to avoid relocating signals, two-light, distant-switch-indicator signals, mounted on masts about 11 ft. high, have been provided to give the necessary advance warning.

Because of their intimate relation with the signal system, inspection of the slide fences and their maintenance are largely in the hands of signal department forces. However, the track section forces are required to keep constant watch of the fences in their respective territories, and are subject to call for making any major repairs or for removing any debris which may foul the fences, ditches or tracks.

If a train is stopped at a signal through the operation of one or more of the fence circuit breakers, it is required, after investigation, to proceed under caution until it is beyond the restrictive territory of the signal. The engineman is then required to report the stop indication to the nearest towerman or dispatcher, who immediately notifies the signal department forces. Where any obstructions to the track are reported, the track forces are also notified and called out.

Many Operations

Up to the present time the Pennsylvania has built 16 of the newer type of fence installations, ranging in length up to 3,000 ft. and in height from 4 ft. to about 30 ft. In one stretch of less than three miles between Edgecliff, Pa., and Valley Camp, on the Conemaugh division, there are six separate fence installations, varying from one to five panels in height, and from approximately 300 ft. to 2,250 ft. in length. These six installations, in themselves, involve a total of 6,330 lin. ft. of fence and approximately 15,850 lin. ft. of fence wire.

Figures are not available to show the number of fence operations at all of the installations, but their effectiveness as a safety measure is clearly seen in the record of one of the fences near Glen Union, Pa., on the Williamsport division. Here, within the 13-month period from December 1, 1933 to December 31, 1934, there were a total of 64 fence operations. On two occasions in April, six tons and two tons, respectively, of ice, rock and mud fouled both main tracks, operated the fence and stopped trains. On six other occasions during the year when trains were stopped, the fence had caught and retained ice or rock weighing from 200 to 2,000 lb., which would have fouled the tracks if it had not been stopped by the fence.

In addition to the above, there were 56 other cases of fence operation within the period, causing warning signal indications to be displayed, but not necessarily stopping trains. These were caused by small

slides or rock falls which, in all probability, would not have fouled the tracks. Such indications have occurred at all of the different installations, causing delay to trains on occasions, but this has been deemed justifiable in view of the positive 24-hour protection given to train operation, and the saving made in patrolling the tracks.

In many cases the sensitiveness of the fences has been reduced by adjustment of the circuit breakers, so that only falls and slides of a magnitude which might possibly cause unsafe operating conditions are reflected in danger signal indications. This has reduced materially the number of unnecessary interferences with train movements.

How Distribute Ties?*

By J. L. Southard,
Assistant Cost Engineer,
Chesapeake & Ohio,
Columbus, Ohio

OUR records indicate that the cost of tie renewals is considerably lower when ties are unloaded by work train at the exact spot where they are to be installed. From actual time studies, it has been determined that the overall renewal costs are from one-half to two-thirds greater when the ties are trucked from storage piles or station sidings to the point of renewal.

On the division to which I am assigned, the present practice is to distribute all main-track ties directly from cars. Where this practice is followed, it may sometimes be necessary to hold a few cars under load for a day or two in order to accumulate enough ties to insure a full day's work for the train. In others, this may be avoided, provided the train can be used to advantage on other maintenance work after the ties have been unloaded.

On the Chesapeake & Ohio, ties are now shipped to the various district headquarters in three cycles a year. This method of distribution over the entire system eliminates the piling and trucking of the ties as renewals progress, while it gives the treating plants a better chance to program their seasoning and treating. Where ties are held at the plant for shipment directly to the point of use as renewals progress, it is necessary to store a large number of ties at the plant during the seasoning period, and again after treatment, since all of the year's requirements cannot be treated during the relatively short tie-renewal season. However, the facilities and conditions for storage at these plants are far superior to those out on the line, while the handling is generally accomplished by machinery.

Obviously, the trucking of ties by motor car and trailer increases the probability of personal injury, owing to the extra amount of handling necesary. In some instances, this method cannot be avoided because of delayed shipments, the necessity for using the ties immediately or the small number to be handled. In such instances, regardless of the precautions taken to load and truck the ties properly, unsafe practices develop and injuries occur with disturbing frequency.

A Serious Waste

The piling of ties for later distribution is a serious waste of time and effort, for which there is no constructive return. The extra time required for unloading, and that for piling, loading and again unloading, as well as that involved in the trucking movement, if applied to actual installation, would greatly reduce the cost of renewals. In addition, considerable work is necessary to insure that each pile of the ties is afforded ample fire protection.

From general observation, extending over a period of years, it has been determined that 35 per cent of the injuries connected with the handling of ties occur while unloading, 26 per cent during installation, 22 per cent while trucking, 12 per cent from creosote burns and 6 per cent in connection with piling. About 30 per cent of these injuries can be avoided if the ties are unloaded directly from work trains at the point of renewal.

All railways consider a work train an expensive but indispensible adjunct to track maintenance. A work train would be less costly if it were not for the delays incidental to its operation. Obviously, however, it must be operated in such a way as not to interfere with revenue traffic, which makes it necessary for it to clear all trains using the track which it must occupy. In many cases serious delays occur by reason of the necessity for going to distant points for water.

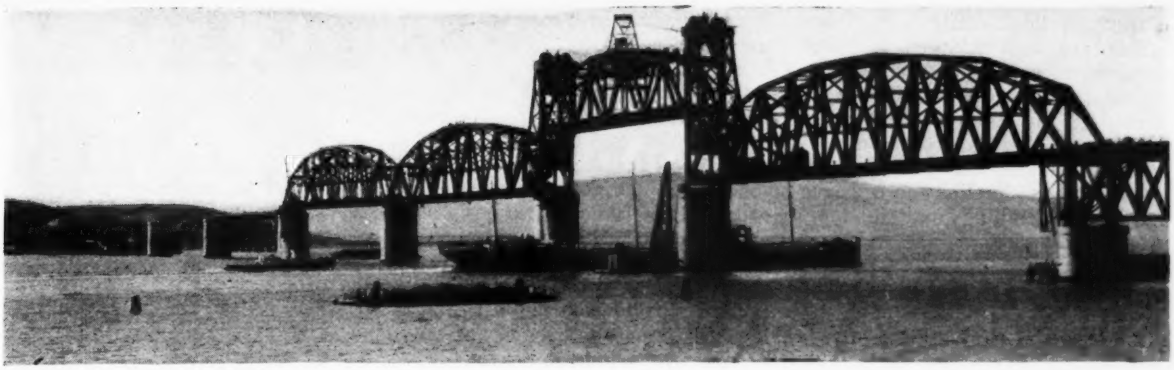
Despite these drawbacks, work trains are necessary, regardless of cost, for the handling of all material of such weight or volume that it cannot be handled by lighter equipment. The value of motor cars and trailers for the distribution of materials, or as a substitute for work trains, is indicated by the reduction in work-train mileage in recent years. This reduction in work-train mileage has resulted, however, from their use for the distribution of smaller and lighter materials, and for the transportation of maintenance of way employees, rather than for either heavy or bulky materials.

Cost

It is susceptible of proof that the cost of work trains for the distribution of ties, provided they are operated under the supervision of an alert conductor, with a man in direct charge of the unloading, and with sufficient work to insure their use during an entire day, will not be a large item in comparison with the cost of shipping the ties in revenue trains to be set out on sidings for unloading, piling and subsequent distribution. Where this is done, the likelihood of personal injuries is increased, and man-power is not used to its greatest productive capacity—a vital necessity in this day of curtailed maintenance.

*This discussion was submitted for publication in the "What's the Answer" department of the May issue, but because of its scope it was withheld for presentation here as an independent article. For further discussion of this subject, see page 296 of the May issue.

Grade Crossing Protection on the Victorian Railways, Australia



Southern Pacific Crossing of Suisun Bay—A Modern Steel Railway Bridge

Better Bridges Require Less Maintenance*

By C. EARL WEBB,
Division Engineer, American Bridge Company, New York

This article comprises a review of the advances in steel bridge practices resulting from better materials, improved methods and modern equipment. It also shows how refinements in detailing result in longer life and reduce maintenance expenditures. Welding has as yet made little progress in the construction of new railroad bridges, but is proving useful in the repair and strengthening of old structures.

THE building of steel bridges is a relatively new industry, and its development can be traced to the growth of the railroad systems. As the locomotives were made larger, the earlier timber bridges and trestles had to be replaced with steel structures, and the lighter steel bridges eventually had to be replaced with others designed for heavier loads and greater train clearances. The government has also demanded greater vertical and horizontal clearances for bridges over navigable streams and this has necessitated the construction of longer spans, and in many cases, where the vertical clearance was small, the construction of movable bridges. Consequently, many different types of movable bridges were designed to suit the different conditions.

Improvements in rolling mill equipment and operations have resulted in a better grade of steel, and it has been found that alloy steel, although more expensive than carbon steel, may be used economically for certain purposes. The basic unit stress for silicon steel, as an example, is about 50 per cent greater than for carbon steel, making the weight of a member designed of silicon steel about one-third less than if designed of carbon steel. The reduction in weight makes it quite apparent that considerable saving can be made in long span bridges.

In nearly all new bridge work over navigable streams, government regulations require that the openings between piers be much wider than in the past. The reduction in dead load, due to the use of high tensile steel, permits bridges of various types to be built with longer spans, and thus meet the government requirements. These longer spans, in turn reduce the number of piers in a multiple-span bridge, which effects a great saving when the cost of deep piers is considered. For the shorter spans, however, there is no economy in the use of the high tensile steels as the saving in weight is negligible due to the minimum sections required by the various specifications and the extra cost for these steels.

The trend in structural engineering during the last few years has been toward a better understanding between engineers and fabricators. This is indicated by the universal application of the solid rolled sections and the "getting together" of the large steel companies in the adoption of sections of uniform size and weight for wide-flange beams. Altogether there are about 50 sets of rolls for solid rolled sections, and by spreading the rolls, different weights for each section are obtained. The largest beam section is 36 in. deep and weighs 300 lb. per ft. The heaviest column section is 18¾ in. by 16¾ in. and weighs 426 lb. per ft. Heavier column or beam sections than these are obtained by riveting cover plates to the flanges.

When used for a column, the solid rolled sections take the place of a built-up section used heretofore, usually consisting of a web plate, four angles and two or more cover plates. When used as a beam, they replace the built-up plate girder and have a larger section modulus for the same weight at a much lower

*Abstracted from paper presented before the convention of the American Railway Bridge and Building Association on October 16.

fabricating cost. The wide-flange beams are well adapted for web members of trusses, and in many of the later bridge designs, they have been used for both web and chord members. There are other advantages in the use of solid rolled sections, such as simplicity in ordering and shop detailing and in more prompt deliveries.

Steel Beam Spans

Some railroads are now replacing their wood pile trestles with wide-flange beams supported on reinforced concrete piles. Because of the small initial cost and the permanency of the construction, these beams will be extensively used in the future for such structures.

Ballast floor construction is coming into more general use in bridges. The riding qualities of a ballast floor bridge are greatly improved as the dead load is considerably greater than for open deck bridges, and due to this increased load and the damping effect of the ballast, the impact applied from the moving load is reduced as much as 50 per cent, in the opinion of some railroads.

This reduction in impact on a bridge, plus the better riding qualities of the train, offsets fairly well the additional initial cost of the ballast floor and the small amount of additional steel. The ballast floor reduces the maintenance cost of a bridge and affords a good protection against fire hazards, which, in my opinion, is not given sufficient consideration. In the last few years, there has been a trend to safeguard these larger and more important bridges by providing a complete steel floor or by making intermediate panels of steel. These panels, acting as fire breaks, are placed three or four panels apart throughout the length of the bridge.

Great strides have been made in welding in recent years, although in railroad bridges which are subjected to high impact stresses, it is well to proceed slowly, as little experimenting has been done as yet on welds subjected to shocks and vibration.

Welding has been found very useful in making repairs and in remodeling old work. The first large project of strengthening an existing structure by means of welding was carried out by the American Bridge Company in 1927 on the Chicago Great Western bridge over the Missouri river at Leavenworth, Kan. The cost of strengthening this bridge by welding was less than the estimated figure for a riveted job, and from reports received, the method used was a success, and the work has proved satisfactory.

Considerable research and tests have been made on different types of compression members, and it has been found that a member with the solid diaphragm web shows superiority over a latticed member. The shop cost of such a member is also considerably less than for one made up with lacing bars. This substitution of a solid web diaphragm for lacing bars parallels the use of larger rivets, especially in heavier members. Rivets 3/4-in. in diameter are now seldom used in bridge construction, and rivets 1-in. in diameter are commonly used for heavy work where 7/8-in. rivets were formerly used. In the heaviest work, 1 1/8 in. and 1 1/4-in. rivets are now common. Rivets should be as large as practicable, taking into account the thickness of material, the number of pieces, and the stress in the member. The larger rivets permit the use of larger fitting-up bolts with which to draw the pieces tighter together, and fewer rivets of larger size are required, thereby reducing the number of holes to be punched and the rivets to be driven.

Erection

The problems facing the erecting engineer of today when starting a new project depend largely upon the physical condition at the site, the time permitted for erection, the particular season of the year during which erection is to take place, the amount of river flow, the maintenance of traffic during erection, and the type of structure. Procedure very rarely can be governed entirely by precedent but must be developed by a study of the different characteristics by engineers experienced in these lines.

In general, under ordinary conditions, small spans will be erected on falsework; whereas, larger spans, crossing deep or swift rivers, will be erected by the cantilever method. The heavier cantilever and continuous types of bridges are practically all erected by this method. In the case of a railroad bridge, which will eventually carry a heavy live load, the cantilever method is economical as the truss seldom needs reinforcing to take the erection stresses. The temporary bents required for the cantilever erection are often made of various members which will later be used in the finished bridge.

The most universal type of equipment used for erecting bridges is the locomotive crane, which is capable of moving along a track as well as picking up and rotating a load. Stiff-leg derricks and travelers are used to advantage in almost every type of bridge. They are usually preferred in larger structures because they weigh less for a given capacity. They can be modified in innumerable ways, so as to adapt them to special needs in the erection of towers for suspension spans and long bascule spans erected in an open position. They are often designed to be drawn vertically up the side of the structure as the erection progresses.

We all know that steel should be kept clean and painted to retard deterioration from rust. Expansion shoes should be kept clean from cinders and dirt to permit them to function properly under live load and temperature changes. The tendency in the last few years has been to substitute the single-segmental rocker for the roller nest. This type of expansion bearing is easier to clean and has less parts to be painted and repaired.

Protection Against Brine

To my mind, the maintenance of a bridge should be well considered at the time it is designed. For a small additional initial cost, considerable saving can be made later in maintenance. To cite an example: An additional cover plate, 3/8 in. or 1/2 in. thick, added to the top flange of the stringers and floor-beams, or even an extra eighth of an inch added to the thickness of a required cover plate, or extra thickness in the top flange angles, adds considerable protection against deterioration of the steel from brine drippings.

Many bridge engineers overlook the fact that this additional weight increases the total cost of a bridge by a very small amount, and it offers good insurance against early repairs. Consider the stringers in a bridge as having 14-in. cover plates. Increasing the thickness of the top cover plate by one-eighth of an inch, results in no additional shop labor and only the extra material involved enters into the cost. The increase in the cost per foot of track, considering two stringers having the thickness of the top cover plate increased one-eighth of an inch, would amount to approximately 20 cents per foot. This same reasoning applies to various details which many buyers and designers try to cut to the limit. In the past, as a rule, bridges required replacements because of inadequate details rather than because of overstress in the main members. The details should give adequate strength to insure economical construction and easy maintenance.

Railroad Track Scale With Two Live Rail Tracks

By H. S. LOEFFLER
Bridge Engineer, Great Northern, St. Paul, Minn.

A View Across the Reconstructed Scale

THE alteration of a track scale to permit the automatic weighing of both 40-ft. and 45-ft. cars is an interesting expedient that was carried out by the Great Northern in connection with the handling of the large volume of gravel and other materials required for use in the construction of the great Fort Peck dam in Eastern Montana. Briefly, the scale, which was originally equipped with live rails 45 ft. long, was modified so as to provide two sets of live rails, 45 ft. and 40 ft. long, respectively.

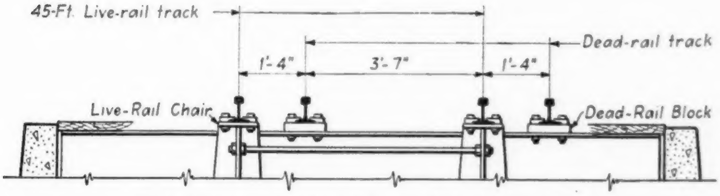
The screened gravel that is being used in building the upstream and downstream toes of the dam embankment is secured at Cole, Mont., on the Hogeland branch of the Great Northern, and is moved over this branch to Saco, thence east over the main line to Wiota, whence it moves over another branch to the dam site, a total distance of about 80 miles. The gravel is moved in trainloads of 70 or more cars and is weighed en route at Glasgow, an intermediate main-line station about midway between Saco and Wiota.

The scale, which was installed by the railroad especially for this service, is a Fairbanks Morse type S 15-75 heavy-duty 60-ft. railroad track scale. It was equipped with a Streeter-Amet type N.T. automatic weight recorder and was provided with a live-rail track with rails 45 ft. in length so as to secure maximum weighing speed for the type of cars to be used, which measured approximately 45 ft. center to center of couplings.

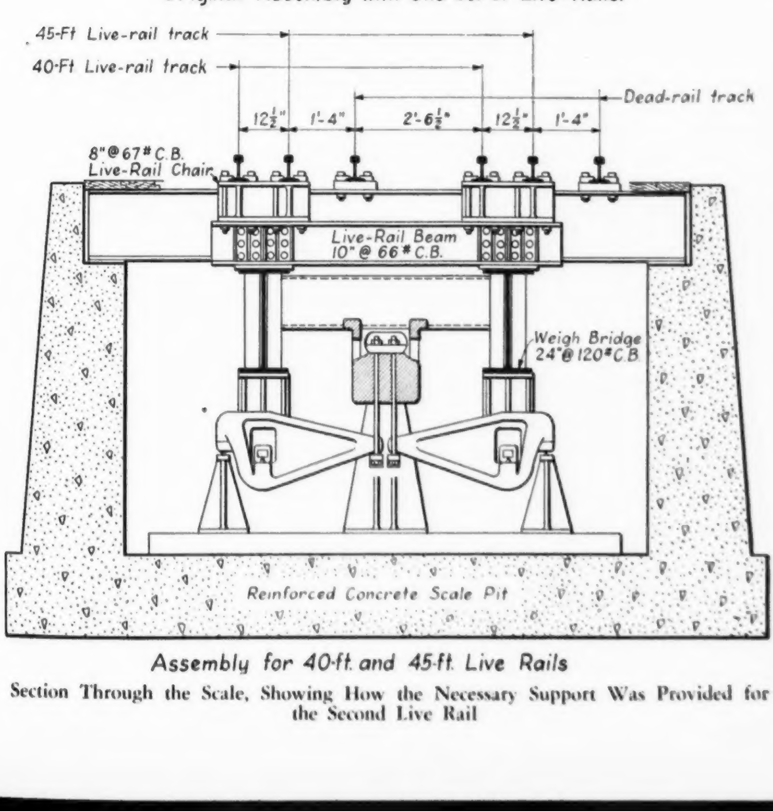
After the scale had been placed in operation, it was found necessary to increase the number of cars in the gravel movement service and the additional cars that were assigned are of a different type with a length of only 40 ft., center to center of couplings. As it was evident that these shorter cars could not be weighed automatically on the 45-ft. live rail, an additional live-rail track with rails 40 ft. long was installed on the scale. The nature of the alteration made is indicated in the two cross sections showing the arrangement of the live and dead-rail supports.

Originally, each live rail was supported on live-rail stands 20 in. high, centered directly over each weigh-bridge beam, (a 24-in. 120-lb. CB. section). In the alterations these live-rail stands were removed and in their stead live-rail beams seven feet long were set in place across the weigh bridge. The beams are 10-in. 66-lb. CB. sections, provided with bearing stiffeners at the two load points, and on top of these, new live-rail stands 10-in. high and wide enough to support two live rails were installed. The two live rails are 12½ in. center to center, symmetrically placed with respect to the center line of each weigh bridge beam.

It was necessary to shift the dead-



Original Assembly with One Set of Live-Rails.

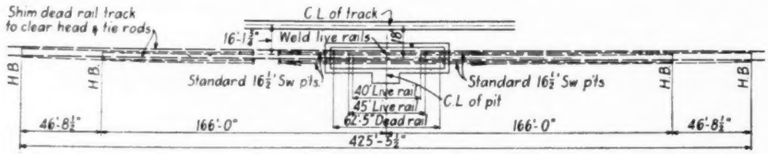


Assembly for 40-ft. and 45-ft. Live Rails

Section Through the Scale, Showing How the Necessary Support Was Provided for the Second Live Rail

rail track sidewise about six inches to provide proper clearance between the rails. No changes were made in the weigh-bridge beams or in the scale irons. Additional trip levers required for the operation of the Streeter-Amet recorder were installed on the 40-ft. live-rail track.

The two lengths of cars now in service are arranged in separate trains (or in groups, as convenient), the 45-ft. cars being operated over the 45-ft. weigh rail and the 40-ft. cars being operated over the 40-ft. weigh rail. The remodeled scale was placed in service on March 14, 1935, and has weighed with entire satisfaction an average of 215 cars a day since then.



Track Layout at the Scale

Trestle Fails Under Train

ON August 6 part of a frame trestle 100 ft. high collapsed under a mixed train on a branch line of the Southern Pacific near Cochran, Ore., resulting in the death of five employees and the injury of three others. The structure was undergoing partial renewal at the time, and according to the report of the Bureau of Safety of the Interstate Commerce Commission, the accident is described as "probably resulting from removal of essential braces." The following account of the accident has been gleaned from the report:

The trestle involved in the accident, which is on a six-degree curve and is known as the Little Baldwin bridge, consists for the most part of five-post frame bents in three stories, the sills of the two upper stories resting on 12-in. by 12-in. longitudinal timbers that rest in turn on the caps of the stories below, there being one longitudinal timber or "overlay" in each line of posts. Each bent in the two upper stories had two sets of sway braces, with a sash brace between them, while in the lower story the tallest bents had four sets of sway braces and three lines of sash braces. There were longitudinal girts in the planes of all the sash braces, and according to a drawing accompanying the report, there were also three lines of diagonal tower braces.

The work in progress at the time of the accident was the renewal of the lower and intermediate stories of the trestle, the upper story having been replaced in 1931, following a fire. At the time of the accident, all of the bents had been replaced in the intermediate story but the new longitudinal girts and the tower bracing had not been installed, and work was in progress in the lower story. In the bottom story, new bents 9 to 14 were in place, but without the tower bracing or girts, and all the old girts from bent 8 to 4 had been unbolted, although they remained in place. New Bent 8 had been erected alongside its final position and the sway bracing of old Bent 8, still under load, had been removed from one side of the bent. According to the bridge inspector, the timber in this bent was "considerably decayed" and the posts had been reinforced with 6-in. by 8-in. timbers at three points some time previously, pending replacement of the bent.

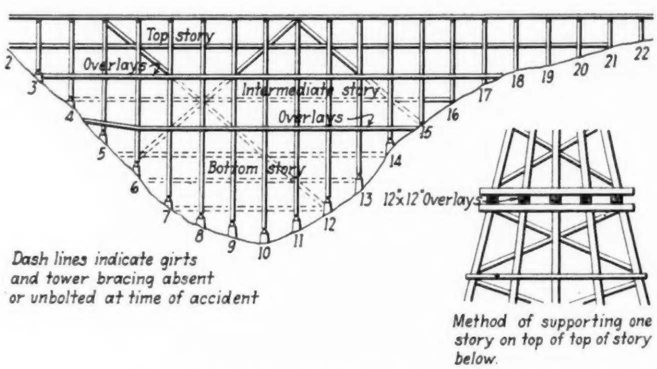
These were the conditions when the bridge failed under the train, which was traveling about four to six miles per hour, the engine, tender and two cars falling to the bottom of the canyon.

Nature of Failure

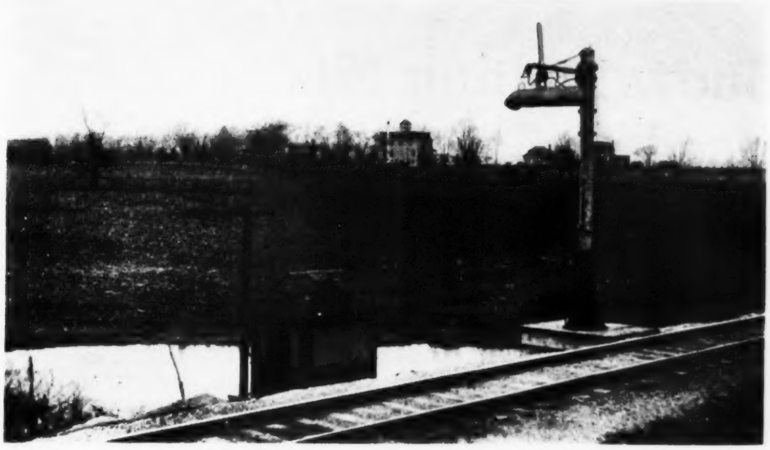
Conflicting testimony and the limited nature of the description of the wreckage given in the report leave some doubt concerning the exact nature of the failure, but it appears that bents 7, 8, 9 and 10 all tipped longitudinally in the direction of Bent 6. Whether this was due primarily to the absence of the longitudinal girts or whether the absence of some of the sway bracing on Bent 8 resulted in the initial failure of that bent by spreading or buckling of posts in that bent is not made clear in the report.

Owing to the absence of the girts, the bents in the intermediate and lower stories were not stiffened against buckling in the longitudinal direction, the tallest bent in the lower story being about 50 ft. high. However, some of the testimony submitted by Southern Pacific officers indicated the opinion that the "overlays" afforded all the longitudinal bracing necessary for safety.

The report calls attention to the fact that an assistant foreman was in charge at the time of the accident owing to the temporary absence of the foreman, that the bridge inspector who visited the bridge seven days prior to the accident had not noticed how much bracing had been replaced, and that the bridge supervisor had made no inspection since the work was started. The discussion was concluded with the observation that "failure of this structure could have been prevented by closer supervision of the repair work in progress by officers charged with that duty."



Sketch of the Trestle at Cochran, Ore.



View of the Direct Delivery Installation at Holly, Mich.

By P. D. FITZPATRICK

Chief Engineer, Grand Trunk Western, Detroit, Mich.

Direct Delivery Pumps Eliminate Water Tanks*

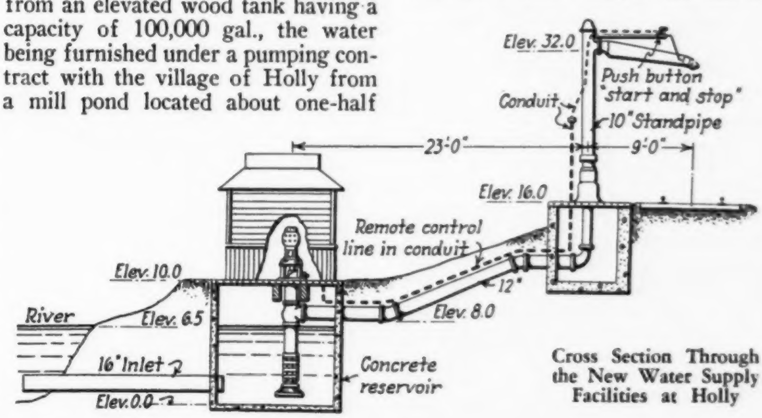
LOCOMOTIVE water storage tanks have been displaced at some of the intermediate water stations on the Grand Trunk Western by the installation of pumping units for handling water direct from the source to the engine tenders. The railroad was first led to a consideration of the new type of pumping installation because of the benefits accruing through the low initial cost and the economy of operation and maintenance.

For purposes of experimentation, installations of the direct pumping units were first made on less important branch lines. The first installation was made in 1929 at North Branch, Mich., on the Cass City subdivision, where an 8-in. vertical sump pump having a capacity of 1,500 gal. per min. was installed directly over a sump fed by two flowing wells, and connected with a water column near the track. This pump was driven by a directly-connected 15-hp. electric motor which is controlled by means of a switch situated on the water column within convenient reach of the locomotive firemen. So efficient and economical did this installation prove to be during two years of operation that similar installations were made at Cass City, Mich., on the same subdivision and at Ashley, Mich., and Sparta on the Muskegon sub-division.

*Abstracted from an article published in the October, 1935, issue of the Canadian National Railways Magazine.

The first installation of a direct pumping unit on the main line was made at Holly, Mich., in 1934. At this point, which is 46 miles west of Detroit, Mich., on the main line between Detroit, Grand Rapids and Muskegon, water had been supplied to locomotives since the early days from an elevated wood tank having a capacity of 100,000 gal., the water being furnished under a pumping contract with the village of Holly from a mill pond located about one-half mile from the tank. In 1934 it became evident that the wood storage tank had reached the limit of its service life and the question arose as to the type of plant that should be installed in its place. In order to avoid the comparatively heavy expense of a new steel water tank and appurtenances, including the wages of attendants, the cost of maintenance and the charge for the water, the railroad decided on a direct pumping arrangement.

The new facility was installed at a point a mile west of the Holly station where the tracks are adjacent to the Shiawassee river which contains an adequate supply of water suitable for locomotive use. Under the old arrangement passenger locomotives obtained water at the Holly station through two water columns but as such engines are now equipped with larger tenders they can avoid taking water at this station. The station therefore served freight trains primarily.



Cross Section Through the New Water Supply Facilities at Holly

The new facilities, which were furnished by Fairbanks, Morse & Co., consist of a 30-hp. 440-volt, 3-phase

motor operating a vertical 4-stage submerged-impeller centrifugal pump, which raises water from a concrete intake well through a 12-in. main to a 10-in. water column. A 6-ft. by 8-ft. watchman's shanty over the intake well houses the motor and pump. Water is admitted into the intake well through a 16-in. galvanized iron pipe 30 ft. long.

Operation of the pump, which has a capacity of 2,950 g.p.m., is controlled by a button situated on the water column within convenient reach of the firemen. The button controls an alternating-current automatic compensator connected to a three-wire accelerating panel. Power for this operation is furnished from the same 440-volt commercial line from which power for operating the pump motor is obtained, the voltage being reduced to 100 by means of an air-cooled transformer in order to avoid the possibility of injury to the firemen incident to the use of the high voltage at the water column.

In order to permit the free flow of water, all working parts were removed from the interior of the water column. Moreover, the discharge piping is on a descending grade of 2 in. in 10 ft. from the water column to the pump, thereby allowing for complete drainage of the standpipe and the discharge line so that no water remains in the facilities above the level of the water in the sump when the pump is inactive. As the pump operates somewhat in excess of its rated capacity, it is readily apparent that a locomotive tender can be filled in a few minutes time.

The new facility was installed at a cost of approximately $3,100, exclusive of the cost of the water column, which was moved from the old location. It was placed in service in the fall of 1934 and the expenditures for maintenance to date have been negligible. The power company assesses a fixed demand charge of $16.88 per month and the energy consumed per month averages 40 kw.-hr., so that the total cost of operating the station is about $18 per month.

A number of years ago plants such as that at Holly would not have been considered dependable; however, power companies are now very efficient in providing constant service to their customers so that the possibility of a failure in the supply of power is remote.

The direct pumping installations that have been made on the Grand Trunk Western were developed by R. Walters, supervisor of water service, and H. E. Smith, supervisor of signals, under the direction of J. A. Clancey, superintendent, all with headquarters at Durand, Mich.

Snow Melting Pits Used at South Station

By **A. S. Tuttle**

Engineer,
Boston Terminal Company

SNOW melting pits have been used to great advantage at the South Station, Boston, Mass., by the Boston Terminal Company. With a layout of 26 intensively-used tracks and 14

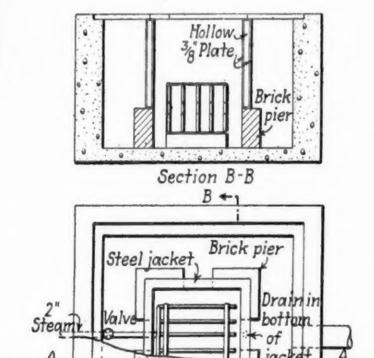
One of the Snow-Melting Pits. When in Use They Are Guarded by a Railing

platforms 7 in. above the top of rail, covered in whole or in part by butterfly type sheds, it is apparent that when snow storms occur the tracks and platforms must be cleared of snow in the shortest possible time, with the least inconvenience to passengers and without interruption to train service.

While this had been recognized for some years, it was obvious that when the track and platform facilities were modernized in 1929-1930, and the old balloon-type train shed was removed, some means should be provided for the disposal of the additional snow which would fall on the platforms and adjacent tracks. With the limited area for piling snow either temporarily or where it might melt naturally, and in view of the amount of labor and the physical difficulties which would be involved in loading out and hauling away large quantities of accumulated snow, it was decided to provide snow melting pits in a number of the platforms. These were located near the outer ends of the platforms to avoid interference with the normal use of the platforms, and, at the same time, to make it possible to use the pits while all except the longest trains are discharging or taking on passengers.

Much of any accumulation of snow on the platforms is pushed by hand plows directly into the pits for disposal, while excess snow on the tracks and the inner ends of the platforms is shoveled on to track push cars and thence moved to the pits. As a result, work-train service, which would be not only costly but would interfere with passenger train movements during many hours of the day, is not required for the removal of snow.

The snow melting pits are constructed of concrete, and are ap-



Plan and Section of the Pits

proximately 6 ft. 9 in. square on the inside, and 4 ft. 6 in. deep. The bottoms are drained to near-by catch basins of the drainage system which serves the station track area, and the tops are covered with 2-in. planking, the center portion of

*This discussion was submitted for publication in the "What's the Answer" department of the December issue, but because of its scope was withheld for presentation here as an independent article. For further discussion of this subject, see page 750 of the December issue.

which, approximately 3 ft. 6 in. square, is removable to permit the admission of snow.

The snow melting element within the pits consists of a steam-heated hollow steel jacket surrounding a pipe coil which ejects live steam, piped from the terminal heating and power plant, into the snow. The steel jacket, which is made up of 3/8-in. plates, is 3 ft. 9 in. square, 3 ft. deep, and 3 1/2 in. thick on a side. This jacket is located directly beneath the removable section of the pit cover and is set 16 in. above the bottom of the pit on brick piers.

The steam coil, which is rectangular in shape, rests on the floor of the pit directly within the jacket. This is made up of about 60 ft. of 3/4-in. pipe, perforated with 3/16-in. holes at intervals of approximately 5 in. to allow live steam, supplied at 100 lb. pressure, to escape into the snow. All of the snow dumped or shoveled into the pit, being confined within the steam-heated jacket, falls directly on the steam coil. The jacket not only confines the snow to the most effective area of the steam coil, but, being heated itself, insures that the snow will have no tendency to adhere to its faces. With one man barring the snow down around the coil, as may be necessary to secure the greatest dissipating capacity of the pits, and to overcome any tendency for particularly heavy snow to arch, each pit will currently dispose of snow as fast as a gang of four to six men can shovel into it.

As might be expected, a considerable volume of steam is emitted from each pit during melting operations, but this is not objectionable because of the location of the pits at the outer ends of the platforms. Furthermore, the amount of steam emitted can be reduced to a minimum by keeping the pits well filled with snow while in operation, and by shutting off the steam by the hand valve provided at each pit, during intervals between charges.

Shield for Pier Inspection

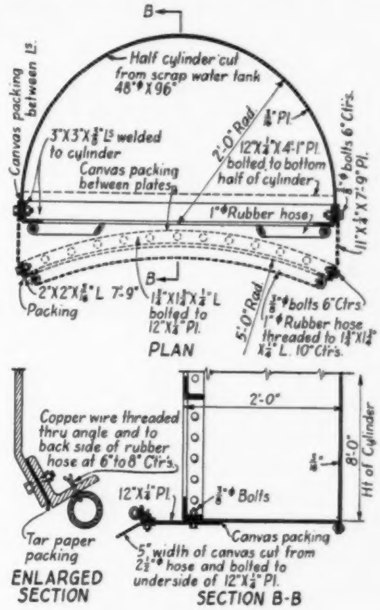
FINDING it necessary to examine the under-water section of the rest pier of one of its bridges, the Louisville & Nashville developed a unique method of uncovering the submerged surface without resorting to the expense which would have been involved in the construction of a coffer dam, at the same time eliminating the uncertainty which might have characterized a diver's examination in a turbid stream.

An old water tank 4 ft. in diameter and 8 ft. long, having one end closed and the other open, was cut in half longitudinally and stiffened by means of structural angles. Rubber hose was then applied to the edges of the half cylinder, which were to come in contact with the plane face of the pier, and fastened in place by means of copper wire spaced at intervals of 6 in. to 8 in. to form a running gasket along these edges to exclude water when pressure was brought against the outer surface of the half cylinder. When the half cylinder was lowered alongside the pier, it was held against the face of the masonry by means of cables until it had been pumped out sufficiently for the external pressure to hold it against the surface.

To examine the rounded ends of the pier it was necessary to splice additional plates at the top, bottom and sides to build up a shape that would conform to the curved surface. The solid lines in the drawing indicate the form used to fit the plane surfaces and the dotted lines indicate the addition necessary to fit the curved ends of the pier. This device was entirely satisfactory and the cost was so low as to be practically negligible.

No difficulty was experienced in unwatering the cylinder with an ordinary trench pump, so that a complete investigation could be made. One-inch hose was used for the packing, or gasket, along the contact edges, with the addition of a canvas flap on the outside of the hose. Experience indicated, however, that the leakage during unwatering would have been less if a hose of larger diameter had been applied. The unwatering progressed slowly at first, but more rapidly as the pressure of the outside water increased, the leakage decreasing progressive until, when the cylinder had been completely unwatered, there was no further leakage.

The manner in which the stiffener angles, plates and hose were applied is shown in the drawing. The details also indicate the method employed to insure water-tight joints through the use of canvas and tar paper. This scheme was devised and applied by J. M. Salmon, bridge engineer. We are indebted to G. R. Smiley, chief engineer, for the foregoing information and sketch.



Details of the Shield

Ditching Costs

(Continued from page 21)

mileage of territory that was ditched and bank-widened during the year.

Because of the large savings effected in the cost of ditching and widening banks by the method described, such work has been carried out over a larger territory and more frequently during the last few years than heretofore. The resulting benefits have been substantial. Improved drainage conditions in heretofore soft cuts have resulted in more stable track and decreased expenditures for maintenance. In addition, because of the drier and more stable roadbed, it has been possible to increase allowable train speeds at a number of points by making permanent improvements in grade and alinement.

Considerable savings have also been effected in the cost of handling company material. During the season mentioned, crews of local freight trains devoted about 315 hr. to this work, of which about 200 hr. was overtime. The cost of this work averaged $3.40 per car of material handled.

Protecting Untreated Surfaces

When it becomes necessary to bore holes in treated timber of piles in the field, what means should be employed to protect the untreated wood that is exposed?

Uses Pressure Application

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Timber is treated to protect it against attack from decay-producing organisms. Since the zone of thorough impregnation by the preservative is relatively narrow, and the retention of the preservative diminishes rapidly below this zone, any break in the surface of the timber or pile by cutting or boring may completely nullify the value of the treatment and may reduce its life to about that of an untreated stick. For this reason, the cutting and boring of treated material in the field should never be permitted, except in cases of extreme necessity. It is practically impossible to bore piles for brace bolts before they are driven, however, so that these holes must of necessity be bored in the field.

Where this is done, it is of first importance to employ some dependable method which will insure adequate protection to the bored surfaces. Our practice, which we believe to be effective, is to plug one end of the hole and apply a specially designed pressure pump to force hot creosote into the hole until the wood refuses to absorb any more. After this, the bolts are covered with a hot mixture consisting of 50 per cent of creosote and 50 per cent of coal-tar pitch. Immediately thereafter the bolt is forced through the hole, the coating on the bolt being sufficient to seal the hole against the entrance of water. In some cases it is also advisable to make a liberal application of the mixture around the bolt hole, underneath the washer, to insure that seasoning cracks will be filled. Tests made of timbers protected in this manner, by submerging them in water for periods up to 18 months have been negative with respect to the penetration of water around the bolt holes.

Swabs With Bottle Brush

By C. C. Westfall
Engineer of Bridges, Illinois Central, Chicago

We have tried different methods for protecting the exposed wood where timbers and piles are bored in the field, using hot creosote. Since most of the wood thus exposed is heartwood, which will absorb very little of the oil, we have concluded that the proper solution of the problem may be not to depend so much on impregnating the cut surfaces with creosote, as to seal these surfaces against the entrance of moisture, trusting that some of the creosote will penetrate into the wood. Accordingly, we have adopted the use of a mixture consisting of 10 per cent creosote and 90 per cent waterproofing pitch, the same as we use for the protection of the exposed surface of piles when cut off. This mixture is heated and the bolt hole is well swabbed with it by means of an ordinary bottle brush. In all cases the holes are bored to the exact diameter of the bolt, and the mixture is applied liberally. This permits the wood to absorb some of the mixture and it is believed that it seals the surfaces as well as the hole itself against the entrance of moisture.

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in March

1. *What is the primary purpose of ballast? What characteristics should it possess? What should be the minimum depth for different materials?*
2. *Since pile bents cannot always be driven accurately, how can one obtain the information necessary to preframe the timbers for a long trestle?*
3. *When laying rails of the same length as those released, should the new joints be laid in the same place as the old ones or, say at the quarter points of the old rail? Why? Does the kind of ballast make any difference? Why?*
4. *What is the purpose of a priming coat? Does the mixture differ from that for succeeding coats? If so, how? How should it be applied?*
5. *What factors indicate the need for reballasting or resurfacing track? Of what importance is each?*
6. *To what extent should pumpers and district repairmen be expected to maintain electrical equipment at a water station?*
7. *What methods of track inspection should be employed in large yards? In what ways do these differ from those employed on main tracks?*
8. *What stock of materials should a bridge or a building gang engaged in general repair work carry with its outfit cars?*

Hot Creosote Best

By Allen E. Kile
Bridge and Building Carpenter, Southern Pacific, El Paso, Tex.

When it becomes necessary to bore holes in treated timber or piles in the field, and this should not be done unless the need is real, the most effective

method of protecting the wood thus exposed is to apply hot creosote to the untreated surfaces. Holes bored for bolts should never be more than 1/16 in. larger in diameter than the bolt, because if the hole is made larger, there is the ever-present chance that water will enter around the bolt, and decay-producing organisms can find an entrance wherever water can go. These precautions are especially important where holes are bored through stringers into caps and through caps into piling for drift bolts.

Advantage of Insulating Floors

Is there any advantage in insulating the floors of frame stations and office buildings? How can this be done? What precautions are necessary?

Generally Not Warranted

By Frank R. Judd
Engineer of Buildings, Illinois Central, Chicago

Ordinarily, considering the purpose for which a frame building is used and its probable life, the cost of insulating the floors is not warranted. On the other hand, it cannot be denied that the insulation of a floor has a distinct value, since it will reduce heat losses and make the rooms more comfortable. This is true especially of buildings that do not have basements or tight foundations, but which are supported on piers or wooden posts. In some cases, where the insulation of the entire floor area cannot be justified, consideration might be given to insulating the floors of certain rooms, such as ticket offices, freight offices or perishable freight or express rooms.

There are numerous methods of insulating floors, each system having certain distinctive merits. It can be done with rigid board insulation, or by some type of fill insulation. Whichever type is used, however, it is important to exercise care to insure that it is installed in such a way that it will not harbor vermin or insects. It is equally important that it shall not absorb moisture, which is likely to promote disintegration of the insulation and perhaps parts of the structure. Each type of building presents an individual problem with respect to insulation, and must be treated in such manner as to obtain the greatest advantage from the particular type and make of insulation used.

A Serious Leak

By General Inspector of Buildings

In recent years the railways have made enormous strides in efficiency and economy, not only in operation but also in the use of materials. There is one place, however, where a serious leak still remains, which has received little attention. This is in the heating of frame stations and, to a somewhat less extent, offices. In many cases, the potential heating value of the fuel consumed for heating these buildings is largely dissipated through walls, roofs and floors that are far from being weather tight. Properly applied insulation and efficient methods of heating will save anywhere from 25 to 75 per cent of the fuel now being consumed for heating purposes. And this is so small item, taken in the aggregate.

Insulation applied to the floors of waiting rooms and offices in frame passenger stations, to the floors of freight offices and of office buildings is well worth while. Yet it is obvious that only partial benefit can be obtained unless the walls and roof are also insulated. Except in rare cases, especially under present conditions, I would not recommend applying insulation to the floors of existing buildings until the floors need renewal, when the cost of the application will generally be little more than the cost of the material.

Two precautions are necessary, (1) to insure against infiltration of cold air from the outside or the passage of warm air from within, and (2) to prevent moisture from reaching the insulation when the floors are mopped or scrubbed. Both of these contingencies can be cared for if the subfloor is laid as usual and covered with a rosin-sized building paper or a saturated roofing felt, well lapped, and turned up and secured against the outside of the sheathing boards. Next, one or two layers of ½ in. insulating board, depending on the severity of the climate, should be applied, with the joints broken if of two layers, fitting it snugly against the sheathing boards. This should then be covered with a layer of tar or asphalt-saturated felt, also well lapped.

Gaging on Canted Tie Plates

Is it more difficult to gage new rail where canted tie plates are installed? Why? If so, what can be done to overcome the difficulty?

It Is More Difficult

By W. L. Roller
Division Engineer, Chesapeake & Ohio, Columbus, Ohio

It is more difficult to gage new rail accurately where canted tie plates are used, the difficulty increasing with the degree of cant. My observation has been that there is no appreciable difference between flat and canted plates so far as the actual operation of gaging is concerned. The difficulty arises in trying to determine how much the gage will change after the canted plates have become well seated. As an example, a stretch of new 100-lb. RA rail which had been laid to correct gage on tie plates having a cant of 1:20, came under my observation where within a short time the gage tightened as much as ¼ in. and the average amount of tightening was more than ⅛ in.

This change of gage subsequent to laying arises from other causes as well as the cant of the tie plates. It will be more pronounced where ties are not adzed properly in advance of laying the rail and where ties of varying degrees of hardness are used. Again, there seems to be a direct relationship between this change in gage and the eccentricity of the tie plates. Where there is too great a difference between the inside and outside lengths of the plate, the rail seems actually to roll inward. This tendency becomes more pronounced as the degree of cant is increased. In such cases, the inner ends of the plates seat themselves more deeply than the outer ends, thus increasing the inward cant of the rail and producing progressively a tighter gage.

Based on observation and experience, I believe that the chief causes of the difficulty encountered in changing gage are:

1. Improper adzing, including lack of uniformity, which results in imperfect seating of the tie plates. This applies to machine as well as

hand adzing. In machine adzing extreme care should be exercised to keep the adzed surfaces at the two ends of the ties in the same plane. This will bring the top of the rails into the same plane and will avoid any arbitrary change in the amount of cant.

2. Improper design of the tie plate. Where the inner toe length of the plate is too short, particularly in plates of heavy cant, the tie plates seat more quickly on the inside.

It follows, that if the foregoing analysis is correct, the remedy lies in following proper procedure in preparing the track for new rail by proper adzing and by the selection of a proper design for the tie plates, particularly with respect to cant and eccentricity. We believe that the correctness of this view has been demonstrated. In numerous instances a cant of 1:40 has been adopted and large plates of slight eccentricity have been provided, and where the adzing has been done accurately and carefully by machines, this difficulty has been reduced to the minimum.

Machine Adzing Helps

By W. E. Tillett
Assistant Foreman, Chesapeake & Ohio, Maysville, Ky.

When canted tie plates first came into use, hand adzing was the common practice and we had all sorts of trouble with the gage getting tight within a short time after the rail was laid. At that time it was a widespread practice to adze the tie to give a slight cant. When we received our first canted plates, we were not notified of the change in design and we adzed the ties in accordance with our usual custom, and laid the rail to correct gage. After the first few trains, we found that it was slightly more than ¼ in. tight. Fortunately, only a small amount of rail had been laid before this was discovered, but it had to be regaged. In doing so, we made it ¼ in. wide and it eventually returned to approximately correct gage but always gave trouble. By adzing the ties level, much, but not all, of this trouble can be overcome. Power adzing is, therefore, greatly superior to hand adzing, because the work is done with so much more uniformity.

Should Be Well Balanced

By R. L. Sims
District Maintenance Engineer, Chicago, Burlington & Quincy, Galesburg, Ill.

Where canted tie plates are used, it is necessary that the plate be well-balanced to insure accurate gage. How serious the inaccuracy of the gage may be will depend on the design of the tie plate. If a plate is to be well balanced the cant should not be too great and the area allowed for the bearing on the gage side of the base should closely approximate the area on the outer end. If this provision is not made, the higher rail sections tend to tip in on tangents, thus placing an additional load on the already inadequate inner bearing area, with a corresponding reduction on the area outside of the rail, thus causing inaccurate gage which is likely to grow worse progressively.

To correct and maintain gage economically, the cant of the plate should not be more than 1:20, and the bearing of the plate on the tie should be well distributed on each side of the base of the rail. Track laid with the higher rail sections and with tie plates having a cant of 1:40 will generally be about ⅛ in. tight gage after the plates have become seated. This can be corrected, of course, by laying the rail with a gage of 4 ft. 8⅝ in. However, this provides a gage of track that is not standard, and the wide gage affects the holes in ties that are pre-adzed and prebored, for which reason it should not be considered as a correct permanent measure.

Self Protection During Storms

To what extent and in what way should men on snow duty be expected to protect themselves against accident during storms? What supervision should be exercised with respect to safety?

Work Small Gangs

By C. S. Robinson
Engineer Maintenance of Way, Maine Central, Portland, Me.

Where temperatures well below zero persist for extended periods, and where snow storms are frequent and heavy, the best means of protecting men obliged to work outdoors becomes a matter of real concern. Regular men, through experience, are usually well prepared with respect to clothing, especially footwear and protection for heads and hands, but at times it is necessary to employ a large number of inexperienced men. When doing this, one should insist, first, that they procure adequate clothing; second, that they are placed in gangs of such a size that they can be supervised properly by experienced men; and, third, that an adequate number of foremen and assistant foremen, experienced in the type of work and the conditions to be encountered, are furnished properly to supervise the gang. Such details as the prompt observance of the foreman's whistle, standing to one side well in the clear of passing trains, etc., should be strictly enforced.

Even in the haste of expanding an organization rapidly to care for emergency conditions during the winter by the employment of a large number of inexperienced men, the physically unfit should be weeded out and not be permitted to jeopardize themselves or their fellow workmen. Among experienced men, the increasing danger of accidents due to winter conditions, must be constantly impressed upon them, together with the necessity for taking advantage of all regular means of protecting themselves. They must omit no opportunity to find out about approaching trains. In the operation of motor cars each man should be assigned a definite duty with respect to the observance of trains, obstructions and signals. Much can be accomplished in the way of overcoming the handicaps imposed by winter conditions if these precautions are observed faithfully day by day.

Should Work in Pairs

By Robert White
Grand Trunk Western, Pontiac, Mich.

During snow storms, trackmen should never be permitted to work alone. It is my experience that they should be assigned to work in pairs, the importance of this practice being greater in large terminals where train movements are frequent. When working alone, a trackman is more likely to become absent-minded and inattentive to matters pertaining to his personal safety. Where they work in pairs, they are more alert to observe the approach of trains from both directions. Again, if one of them becomes absorbed in his work to the extent of relaxing the proper precautions, has partner serves as a foil to this concentration. The routine discussion of their work operates to keep them mentally alert. On the other hand, I do not approve of the practice

of some foremen of working the entire gang on one switch and then moving on to another when that one has been well cleaned. In this case there may be too much observance of safety precautions, for it is quite certain that only one or two of the men will be working, while the remainder will be watching for trains or doing nothing.

Where casual labor, that is, extra men without experience, is employed, untrained men should never be placed together, but they should be paired with experienced men, even where the foreman is able to be with his men constantly. The foreman may be busy directing certain phases of the work and neglect safety precautions at the wrong moment. During storms, a foreman should not assist in removing the snow. He should go from point to point where the men are working and stimulate them to be alert. He should advise them of the time of scheduled trains and so far as possible, of the movement of extras. In other words, he should key them up to expect the approach of a train at any time. Beyond this every man should look out for himself.

Must Not Work Alone

By D. L. Britton
Section Foreman, Michigan Central, Marshall, Mich.

Men assigned to snow duty should exert every effort to protect themselves against personal injury during snow storms, regardless of any safeguards that may be thrown around them by their superior officers. This applies not only to themselves but to the protection of their fellow workmen. To this end, they should insist on not working alone. The greatest hazards occur in connection with keeping main-line turnouts, interlockings and street crossings free from snow and ice. In the past, we have had a few accidents in which motor cars have been derailed while trying to go through snow drifts or when passing over an ice-filled flangeway at a crossing. In such cases, the foremen or the men in charge have been at fault.

Supervision plays a large part with respect to safety during snow storms. A foreman must, generally, divide his gang, assigning certain men to particular turnouts or interlockings. In so doing, he should always assign them in pairs, instructing one to keep a lookout in one direction and the other to watch in the opposite direction, and to keep their ears uncovered while working. Before allowing them to start, there should be a thorough understanding as to where they will move to safety on the approach of a train. At grade crossings or other specially hazardous points, the foreman should be with his men or he should appoint a watchman to take his place.

Foremen should see that their men are properly clothed for snow duty. Section men have been known to report for duty wearing two suits of underwear, two or even three shirts, one or two vests, a sweater or slip-on and an overcoat or sheep-lined coat tied around with a wire or rope, and either two pairs of trousers and a pair of overalls or one pair of trousers and two of overalls. On their feet they may have two to four pairs of socks, large shoes and a bunglesome pair of arctics; or I have seen them with burlap sacks tied to their feet. They are quite likely to be wearing a stocking cap over which is a woolen or fur cap with the ear laps pulled down; and last, a heavy muffler around the neck, or possibly, a rope to keep the turned-up collar to a snug fit. This is not a fanciful description, but happens quite frequently during severe weather. Obviously, a man dressed in this manner cannot move quickly and is, therefore, more likely to be hurt in an emergency, nor can he do satisfactory work when he is hampered by such an excess of clothing. On the other hand, we sometimes see men dressed to the other extreme, especially among the extra men who must be employed. The latter soon become chilled and are then less dependable than those who are overdressed.

Clearly, track laborers are not in position to buy light but expensive clothing which will afford full protection against cold winds and snow, but with proper management they can do better than to dress in the extreme manner described, for dressed in this manner one can scarcely see or hear, let alone move quickly.

Poured or Lead-Wool Joints

What are the relative advantages of poured-lead and lead-wool joints for cast-iron pipe? How should each be made?

Efficiency the Same

By C. R. Knowles
Superintendent Water Service, Illinois Central, Chicago

So far as the efficiency of the finished joint is concerned, there is little choice between the lead-wool and the poured-lead types. The principal uses for lead wool are in repair work, for calking in wet trenches or on mains that are submerged, where the use of molten lead would be difficult or impossible. It is also used on cast iron pipe lines where the bell ends point downward. Lead-wool joints are more expensive than poured joints, the labor cost being much more, since the lead wool must be calked strand by strand, while the material costs about twice as much as pig lead. On the other hand, in general, less lead wool is required to complete a joint. For this reason, roughly, the cost of a finished lead-wool joint is about one and one-half times that of a poured-lead joint.

When using either lead wool or molten lead, the joint should be packed with clean, sound hemp or yarn, braided or twisted, and driven tightly into place. Before running a poured-lead joint, the surfaces should be carefully wiped out clean and dry, and should then be filled completely with lead at one pouring, with the spout of the melting pot as close as practicable to the joint to be poured.

Prefers Poured Lead

By R. N. Foster
Water Engineer, Wabash, Decatur, Ill.

Under normal conditions, poured-lead joints are preferable, since the cost of the material, the labor cost of making the joints and the time involved are all less than for the lead-wool type. They also makes a better joint. On the other hand, lead wool is preferable where it is impracticable to keep water from the joint while pouring the lead. In some cases, lead wool is used instead of oakum in poured-lead joints where it is difficult to keep water from coming through.

Calking should be done in such a way as to insure a tight joint without overstraining the metal in the bell of the pipe. In all cases the calking should be done toward the place of the gate. The joint should be poured and calked after the pipe is laid in the trench in correct alinement.

When making a lead-wool joint, the lead wool, which consists of very fine strands of lead, is calked into the

joint cold in the same manner as the yarn or hemp which is used for packing poured-lead joints. Each strand is calked separately, however, and care must be exercised to insure that the successive strands overlap in such a way as to break joints with the strands calked in previously. When the face of the hub is reached, the joint is finished as with poured lead.

Cinder Disposal in Winter

What methods should be employed in disposing of cinders during winter weather?

Depends on Many Factors

By E. H. Thornberry
Chief Engineer, Peoria & Pekin Union, Peoria, Ill.

If only a few cinders are involved and space is available, it may be best to store them on the ground near the cinder pits where they can be picked up in the spring. If idle equipment is available, it may be possible to store them in cars either for emergencies or until there is a sufficient accumulation to make it worth while to unload them with a work train when the necessary force can be spared from other work. In large terminals where a large volume of cinders must be disposed of, and tracks are usually busy, the solution of the problems requires co-operation between the mechanical, the transportation and the maintenance departments, especially during severely cold weather. The mechanical department should exercise care to see that no more water is used for quenching the cinders than is absolutely necessary. The transportation department should move them promptly on request, so that they can be unloaded before they freeze solidly in the cars.

Except in cases of emergency requiring the use of the cinders on the tracks, I believe it to be good practice to arrange with municipal officers or representatives of the state highway department before cold weather sets in, to accept a certain number of cars of cinders at specified points each week. This can be done with the understanding that they will be unloaded promptly free of expense to the railway. Otherwise, they should be loaded into air-dump cars and unloaded at selected points for widening banks.

Numerous Outlets

By George M. O'Rourke
District Engineer, Illinois Central, Chicago

To answer this question one must know whether any value is placed upon the cinders. If not, arrangements can sometimes be made with local street or highway maintenance officers to haul them directly from the pits in trucks or wagons. They may sometimes be sold for a fixed sum to authorities in towns some distance from the point where the pits are located, in which event freight charges are assessed. Again, they may be donated to schools or churches for repairs to grounds, driveways or walks. In some cases it has been possible to arrange with highway commissioners to spread them on approaches to grade crossings after the roadway department has dumped them at the crossing. In these cases they are of some value to the railway.

Where the railway places a value on the cinders as material for ballasting or bank widening, it becomes necessary to resort to various schemes to get the most out of them for the least expenditure. If they are to be used for either purpose within the switching limits of the engine terminal where they originate, they can usually be handled in air-dump cars before they freeze. Cinders solidly frozen may cause a dump car to overturn when it is dumped. If time and space permit, they can be piled on the ground near the pit until they drain. When they are loaded into cars later, the cinders may be frozen into chunks but they will not freeze to the cars.

If loaded cinder cars must be moved some distance, special cars having a ridge along the center and doors along the full length of the car, are desirable. If a road has no cars of this design available, Haskell & Barker ballast cars are about the next best design for use in cinder service. During the witner the cinders will freeze to the floor of the cars to a depth of 12 to 18 in. but since they are regularly assigned to cinder service, there should be no objection to allowing this frozen layer to remain until the weather is sufficiently mild to permit it to be removed.

Where neither of these types of cars are available, it may be necessary to resort to coal cars, in which event equipment with side dumps the full length of the cars should be selected. The greatest difficulty with cars of this design is to get the side dumps down. After this has been accomplished, holes can be punched through the crust frozen over the top of the load, using lining or tamping bars, through the unfrozen layer and then through the frozen layer on the floor of the car. Tamping bars are preferable for this purpose because of the ease with which lining bars slip through the hands, dropping through the holes with the loose cinders, causing loss of time and creating a hazard of accident and personal injury.

Many passing sidings as well as other sidings and yard tracks are ballasted with cinders. Arrangements can be made to set out loaded cinder cars on such tracks late in the day for unloading early on the following day. When the working season opens, the cinders so unloaded will be available for surfacing and for widening the bank to provide a good walkway for trainmen when looking over their trains.

Roads in the South seldom experience cold-weather troubles connected with cinder disposal comparable to those in the North. Roads in the North having lines reaching into the South can sometimes use cinders to advantage from the northern engine terminals, but as this usually takes the cars far past their loading points such shipments are seldom practicable.

So many local conditions influence the methods that can be followed that when it comes to actual practice, the effective and economical means to be employed depends in large measure on the ingenuity of the officer responsible for handling them.

Depends on Climate

By C. G. Fulnecky
Assistant District Engineer, New York, Chicago & St. Louis, Frankfort, Ind.

Climatic conditions have the most direct bearing and the largest influence on the methods to be employed for winter disposal of cinders. In the South, where frost seldom penetrates deeply, cinders can usually be disposed of as easily in the winter as in the summer. Even in the North, where the winters are severe, there will be periods of temperature when little trouble will be experienced.

During severe winter weather, however, the cinders may freeze solidly in the cars, making it very expensive to unload them. An economical method under these conditions is to unload them into stock piles, provided the necessary space and trackage are available not far from the cinder pits. By taking them from the cinder pit

and unloading them on the stock pile before they have had a chance to freeze, the difficulties otherwise experienced will be eliminated. The track can be raised on the fresh unfrozen cinders as necessity requires. Obviously, this method can be employed most advantageously at points where cinders accumulate in considerable volume. In the spring, they can be loaded with a clamshell and used for ballast or other purposes as desired.

Where too few cinders are made or space is not available for stock piling, probably the best practice is to set the car or cars out on a siding and do the unloading as time is available. In this event the cinders will likely be frozen solidly and it may be possible to hold them until the weather moderates. It is also sometimes practicable to set a car in the enginehouse until it thaws out, after which it should be unloaded immediately. If special cars, such as ballast cars, are available, or there is surplus equipment for commercial loading, it may be possible, at points where few cinders are made, to store them in cars until they can be unloaded.

Advantages of Dating Nails

In view of the recognized value of treated ties, is there now any advantage in the use of dating nails? Why? If so, what records should be kept of the dated ties, and by whom?

Greater Now Than Before

By C. G. Fulnecky

Assistant District Engineer, New York, Chicago & St. Louis, Frankfort, Ind.

There is even more advantage now than in the past in the use of dating nails, since this provides the surest means of obtaining a record of the life of ties. Different woods are purchased from different localities in any one year and in successive years, while the method of treatment may be changed from time to time. If there is any value in knowing what the performance of these various groups is, a record should be kept by kinds and treatments. The principal advantage of such a record is that it can be used as a guide for future purchases and treatments. The simplest way to keep it is through the use of dating nails.

If such a record is to be kept, and I believe that it should be, it should be done by the person responsible for the purchase of the ties. It should include the species, the place where grown, the season when cut, the preservative and the method of treatment. So far as practicable, these ties should be kept together in groups by species, locality of origin and treatment. This information should be forwarded to the division engineer and by him to the supervisor receiving the ties, who should give copies to the several section foremen to whom the ties are distributed.

When a foreman applies dating nails, he should record the data by mile posts where the ties were installed, the kind of ballast, condition of the roadbed, drainage, etc. This information should be sent to the supervisor for entry on the permanent record, a copy of which should be forwarded to the division engineer. When a tie is removed, the foreman should report the cause of failure and the date removed. All of this information should be relayed to the officer who is in charge of the system records, so that his record may always be complete and up to date.

Less Advantage Now

By H. R. Duncan

Superintendent Timber Preservation, Chicago, Burlington & Quincy, Galesburg, Ill.

There is no question that the value of treated ties is now fully recognized and doubtless some of the information which was instrumental in securing this recognition has been obtained through the use of dating nails. There is, perhaps, less reason for using dating nails today than in the past; yet there is still some advantage in their use.

One of the reasons why we consider them less necessary now than formerly is that all ties in our tracks today are treated. On the other hand, our present use of dating nails enables us to make some comparisons with respect to the life obtained from ties of various species and similar comparisons of the results we are securing from individual species treated with different chemicals and different processes.

Another reason why we do not consider dating nails as important at present as in the past on our own road, and this applies to other roads as well, is that we brand the ends of our ties as they pass through the adzing and boring machines. We believe that this branding will give us the information we desire as to the age of ties. It does not, however, give us the date they went into the track, and we have not been branding ties long enough to know whether the brand will be legible enough to enable us to read the date when the tie is finally removed from the track.

For many years we put a dating nail in every tie when it was inserted in the track, but we have not done so in recent years. In making an analysis to determine whether the practice should be continued, we estimated that the average cost per year was about $12,000.

Yet to enable us to determine with sufficient definiteness what results we are obtaining from the ties we insert year by year, we have selected as representative locations, two sections on each operating division of the system which we have designated as "dating-nail sections." On these sections, dating nails are applied to every tie inserted; dating nails are also applied to all ties used for replacements in each of our special test tracks. In our opinion this plan will give us all of the information we need for any class of material and any treatment under the diverse traffic and climatic conditions which obtain on our road.

All records of dated ties are kept in the office of the superintendent of timber preservation. These are not kept for individual ties, nor do we believe such a record is necessary. Every year all dated ties are inspected by the roadmaster, the district engineer maintenance of way and the superintendent of timber preservation. If the inspection discloses unusually long life or evidence of premature failure, or in other words, anything unusual, it is possible for us to correlate this and previous inspections to provide a complete history of the dated ties.

Would Continue Their Use

By E. L. Crugar

Chief Engineer, Wabash, St. Louis, Mo.

A sufficient reason for continuing the use of dating nails lies in the fact that the value of treated ties is recognized. It is often desirable to check on the performance of timber from various sources, and on different methods of treatment. The use of dating nails provides a practicable method of following the performance of individual groups of ties in any investigation. Dated ties, through systematic inspection, give an accurate record of renewals in any track over

a period of years, and indicate definitely any abnormal situation or performance. This record has a salutary effect on foremen and others having charge of tie renewals.

Some roads have rules covering multiple tie renewals, which can be enforced or checked only by the use of dating nails. Records kept must obviously conform with the information required by the individual line, but they should be very simple. Elaborate record systems will not reflect information compatible with the cost of keeping them and soon become so unwieldy as to defeat the purpose for which they are kept. When considering any system of tie records, it should be borne in mind that millions of units are involved and that the simplest practicable system will give the best results.

Ties Should Be Dated

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

I believe that every tie inserted in the track should be dated. It is of little importance, however, whether this be done with dating nails or by branding. Some of the dating nails are sure to be lost during the life of treated ties. On the other hand, some of the brands will as surely become obliterated, especially if the use of mauls or sledges to shift the ties into the proper position is not prohibited.

I am not so certain about the value of keeping a record of all ties inserted. Even the simplest record will shortly become too voluminous to handle if it includes every tie used every year. If we assume the average life of all ties to be 20 years, then the tie in any group having the longest life will remain in the track for, say, 35 to 40 years. This means that the record for each year's installation must be kept alive for that length of time. Aside from the work involved in keeping such records, section foremen are seldom good bookkeepers or record clerks, for which reason enough errors are likely to creep in to affect the accuracy of such a record. On the other hand, if certain stretches of track are selected as test sections, they can be supervised more easily and the foremen in charge can be trained to make the simple reports necessary. To my mind the information gathered in this way will be fully as valuable as if it covers an entire railway, while it can be expected to be more dependable.

There is a value in dating ties far beyond their cost. This practice tends to give the ties a personality and the foreman takes an interest in them individually, which he does not take in undated ties. It has been my observation that dated ties do not come out until they have actually failed, while too many undated ones are taken out on suspicion, although some of them might have lasted a year or two longer.

Plates or Slabs for Floors

What are the relative advantages of steel or wrought-iron plates and concrete slabs for the floors of ballast-deck spans?

Evidence Is Inconclusive

By General Bridge Inspector

This is a somewhat controversial question since each form of construction has many advocates. It is also difficult to put one's finger on sharply defined advantages of either type over the other, since they have certain characteristics in common, such as continuous track construction, water tightness, etc. One of the principal advantages claimed for the concrete slab is its long life, but the advocates of metal floor plates contend that if they are given the same waterproofing protection, they will last as long as the concrete. This is a matter, however, that only time will tell.

Floor depth may be a matter of great importance, particularly in grade separations, or at points where headroom is restricted and a track raise is either not practicable or will run into large costs. Those who favor the floor-plate construction insist that shallower floors are possible with the plates than with the concrete slab. On the other hand, it has been demonstrated that floors of similar depth can be designed with concrete slabs, although designers have not always done this with an equal measure of economy.

Ballast-deck floors are often employed in grade separations, primarily because of the protection they afford to vehicles and pedestrians against dripping water and droppings from cars, such as coal, ore, sand, etc. It is contended that a concrete slab, properly waterproofed, is the best protection that can be afforded. This is countered with the assertion that either steel or wrought-iron plates can be welded to give the same degree of water tightness.

When all of the evidence is analyzed, it is found that both types of construction have been used to advantage in similar situations and that each possesses enough of the characteristics of the other to make it difficult, if not impracticable, to select any one which is outstanding as compared with the other material.

Difficult to Evaluate

By P. G. Lang, Jr.
Engineer of Bridges, Baltimore & Ohio, Baltimore, Md.

An ancient sage once remarked that "there is nothing new under the sun," and this applies with some force to the question, for certainly, the use of wrought-iron and steel plates is not new, since it antedates the era of extensive highway construction. In many cases the adoption of a ballast-deck span has for its principal object the prevention of dripping on the roadway beneath the structure.

Because of corrosion, the Baltimore & Ohio recently removed, after 34 years of service, a bridge having a metal-plate floor upon which ballast had been placed. The sole reason for this removal was deterioration as a result of corrosion, since the design differed in no essential respect from many of the designs which are now proposed. Determination of what the life of a concrete-slab floor may be must await the future.

At present, floor plates of wrought iron are being used where no stress is carried, for which a pronounced corrosive-resistant characteristic is claimed. Furthermore, advances in the art of welding should render it possible to obtain a water-tight form of floor construction through the use of steel or wrought-iron plates.

It may be argued that there is a difference in the floor depth of a plate construction and where a concrete slab is used. As a matter of fact, however, it is possible to attain the same floor depth with either metal plates or concrete slabs, particularly if proper attention is given to the matter of waterproofing. The relative advantages of the two types of construction are difficult to equate or reduce to precise expression. Current preference appears to incline somewhat toward the concrete floor, on the ground of service life, ultimate cost and absence of leakage.

Approve More Grade Elimination Projects

Up to December 14 plans submitted by the various states for grade crossing elimination projects having a total estimated cost of $48,761,000 had been approved by the Bureau of Public Roads. As of the same date contracts had been awarded for such projects totalling $19,237,867, including $1,307,436 in contracts that had been awarded during the week. All projects included in these totals are to be financed from the $200,000,000 fund previously allocated for this purpose from the $4,000,000,000 public works fund.

Santa Fe Budget

The directors of the Atchison, Topeka & Santa Fe have approved a budget for 1936 providing for the expenditure of $28,408,973, including $3,601,302 for the laying of rail on 333 miles of line, $2,000,000 for change of line work, $438,313 for bridges, trestles and culverts, $293,107 for widening cuts and fills, $229,401 for ballast, $188,157 for additional yard tracks, sidings and industrial tracks, $113,609 for road machinery and tools, and $63,913 for the construction of water stations and appurtenances.

Daniel Willard Attains Record Length of Service

Daniel Willard, president of the Baltimore & Ohio, now enjoys the distinction of being that railroad's chief executive with the longest tenure of office. The record was formerly held by John W. Garrett, Civil War president of the B. & O., whose administration lasted from November 17, 1858, to September 26, 1884, or 25 years, 10 months and 9 days. Since Mr. Willard was elected president of the B. & O. on January 15, 1910, his record became equal to that of Mr. Garrett on November 24, 1935. At the meeting of the B. & O.'s board of directors recently in New York, Mr. Willard was re-elected president of the railroad for his twenty-seventh term.

"Eliminating the Section Gang"—A Correction

In the article bearing the above title, describing the reorganization of track forces on the New Haven, which appeared in the December issue of *Railway Engineering and Maintenance*, it was stated erroneously that the larger gangs of the new organization include normally from 10 to 15 men. This should have read, "from 20 to 30 men." In addition, the captions under the two illustrations in this article of the highway motor trucks being used by the track forces, on pages 734 and 736, are transposed.

Norfolk & Western Annual Track Inspection

ONE of the few roads to make an annual track inspection during 1935, accompanied by prize awards to foremen for excellence in the general condition of their territories, was the Norfolk & Western. As in past years, first, second, third and fourth prizes of $40, $30, $20 and $10, respectively, were awarded generally to foremen on each roadmaster's district. Altogether, 81 foremen won prizes totaling $2,090.

On the basis of 10 as perfect, the highest division honors, for the second successive year, went to the Scioto division, with a rating of 9.35, as compared with 9.33 in 1934. The second highest division honors were won by the Roanoke Terminal for the second successive year, which received a rating of 9.33 in 1935.

The Roanoke-Walton roadmaster's district received the highest district rating of the year, and the highest rating ever given to a roadmaster's district, 9.40. The Williamson-Kenova district received the second highest rating of 9.38. The territory of Ernal McCann, on the Scioto division at Sardinia, Ohio, and that of J. W. Neikirk, on the Radford division at Rural Retreat, Va., each with a rating of 9.48, tied for first section honors. Mr. McCann's territory received the highest award in 1933, with a rating of 9.49, and tied for the highest award in 1934, with the same rating. The second highest section rating for 1935, 9.47, was given to John Layne, on the Pocahontas division, with headquarters at East Williamson, W. Va. Fifty-eight of the 81 prize winners in 1935, or 72 per cent, were prize winners in 1934.

Western Roads to Extend Store-Door Service

The most extensive application of free pick-up and delivery service ever undertaken will be inaugurated by 100 railroads in Western Trunk Line territory on January 20 when the service will be made available at 9,000 to 10,000 of the 13,000 stations in this area. Under this plan there will be no change in existing rates on class and commodity shipments eligible for the service but shippers and receivers providing their own trucking will be allowed 5 cents per 100 lb. There will be no minimum weight requirement and any article weighing less than 4,000 lbs. will be picked up and delivered, although articles of excessive length, width or height will not be accepted. At most points there will be no minimum charge on shipments handled in one day and no deficiency charge on small accounts. With this service in effect pick-up and delivery service will be offered by more than 300 railroads at more than 18,000 of the 78,000 stations in 44 states.

Two More High-Speed Trains for Union Pacific

Two more Diesel-electric streamlined trains have been ordered by the Union Pacific from the Pullman-Standard Car Manufacturing Company. The new trains, which will have 10 cars each, will be placed in service in June between Chicago and Denver, Colo., via the Chicago & North Western and the Union Pacific, on a schedule of 16 hr. for the 1,048 miles, thereby effecting a saving of more than nine hours as compared with the present fastest schedule between these points. With an average speed of 65.6 miles an hour, including stops, the new trains will be the fastest in the world for distances of 805 miles or more. Furthermore, with an average speed of 70 m.p.h. for the 560 miles between Omaha, Neb., and Denver, the new trains will be the fastest in the world for distances greater than 360 miles.

Each of the new trains will consist of a 2,400-hp. tandem power unit and 10 cars, including three Pullman sleeping cars, a Pullman room and observation car, a dining car, two coaches and three cars for baggage, mail and express. These new trains, which will be known as the Streamliners—City of Denver, will give the Union Pacific a fleet of six streamlined trains—two for service between Chicago and Denver, one between Chicago and Portland, Ore., two between Chicago and San Francisco, Cal., and Los Angeles, and one between Kansas City, Mo., and Salina, Kan.

Railroad Income Shows Upward Trend

For October the Class I railroads of the United States had a net railway operating income of $75,425,092, which was at the annual rate of return of 2.28 per cent on their property investment, as compared with a net of $49,336,307, or 1.48 per cent, in October, 1934, according to reports compiled by the Bureau of Railway Economics of the Association of American Railroads. Operating revenues for October amounted to $341,017,864 as compared with $292,910,284, an increase of 16.4 per cent, while operating expenses totaled $232,515,601 as against $211,963,281, an increase of 9.7 per cent. For the first 10 months of 1935 these railroads had a net railway operating income of $397,458,232, or 1.79 per cent, as compared with $393,922,090, or 1.76 per cent, in the corresponding period of 1934. Operating revenues for the 10 months totaled $2,852,939,288 as compared with $2,757,083,289, an increase of 3.5 per cent, while operating expenses totaled $2,149,186,962, as aginst $2,047,048,874, an increase of 5 per cent.

Association News

Roadmasters Association

Members of the Executive committee met in Chicago on December 7, including President Chinn, Vice-President W. O. Frame, Secretary T. F. Donadoe, Assistant Secretary C. A. Lichty, Treasurer E. E. Crowley, Directors R. H. Carter, A. H. Peterson and J. J. Clutz and Past-President Elmer T. Howson. The committee selected members of the five committees to report on subjects selected at the last convention, and acceptances are now being secured from these members. As a means of stimulating membership, the Executive committee authorized the waiving of the entrance fee of $1 until the close of the next annual convention. The Hotel Stevens was selected as the headquarters for the next annual convention, which will be held on September 15-17.

Wood Preservers Association

The thirty-second annual convention will be held at the Peabody Hotel, Memphis, Tenn., on January 28-30. Among the features of the Tuesday forenoon program of special interest to railway users of treated timber are the report of the Committee on Preservatives and a paper on Creosotes—Their Toxicity, Permanence and Permanence of Toxicity by W. H. Snell and L. B. Shipley. On Tuesday afternoon, reports will be presented on the pressure treatment of ties, of timber and lumber and of poles and on the non-pressure treatment of poles, on tie service records and on bridge and structural timber. On Wednesday forenoon, H. F. Sharpley, assistant chief engineer of the Central of Georgia, will present a paper on The Experience of the Central of Georgia with the Use of Treated Materials, followed by reports of the committees on Marine Pole, Pole and Post Service Records and on the Diversified Uses of Treated Wood.

On Thursday forenoon, Nelson C. Brown of the New York State College of Forestry, will present A Long-Range View of Lumber and Cross Tie Production and Some Factors Bearing upon the Future Use of Treatable Materials in the United States.

Bridge and Building Association

Members of the Executive committee met in Chicago on December 14, with President T. H. Strate, Vice-Presidents F. H. Masters and C. A. J. Richards, Director R. P. Luck, Secretary-Treasurer C. A. Lichty and Past-President C. R. Knowles and Elmer T. Howson present. The committee gave major consideration to the selection of the personnel of committees to investigate and report on subjects selected at the last convention. It also received a report from the Membership committee, outlining plans for bringing the association to the attention of the railway officers responsible for the construction and maintenance of railway bridges, buildings and water service facilities. The committee approved the action of its Arrangements committee to the effect that the Hotel Stevens be selected as the headquarters for the next convention.

International Railway Maintenance Club


E. C. Neville

At a meeting at Niagara Falls, N. Y., on November 21, E. C. Neville, master of bridges and buildings of the Canadian National at Toronto, was elected president; Carroll L. Correy, supervisor of telegraph and signals of the Pennsylvania at Buffalo, N. Y., was elected vice-president; and M. B. Morrison, vice-president of Morrison Metalweld Process, Inc. at Buffalo, was elected secretary-treasurer. At this meeting, which was attended also by the chief maintenance officers of a number of the roads serving the Buffalo-Niagara Falls-Toronto area, John V. Neubert, chief engineer maintenance of way of the New York Central system, was the principal speaker of the day.

Metropolitan Track Supervisors' Club

The meeting at the Hotel McAlpin, New York, on December 12 was given over to a discussion of mechanical tie tampers. Fifty-seven members and guests were in attendance at the session, which was preceded by the usual informal luncheon. The meeting was addressed by representatives of five companies manufacturing mechanical tie tamping equipment. Each representative, supported by lantern slides, motion pictures and models of his tie tamping tools, presented a description of the equipment offered by his company and answered questions from the floor. The speakers and the companies which they represented were as follows:

W. H. Armstrong, manager, tie tamper sales, Ingersoll-Rand Co.

C. B. Coates, electrical engineer, Chicago Pneumatic Tool Co.

W. T. Jones, representative, Barco Manufacturing Co.

D. G. Black, general sales manager, Syntron Co.

E. R. Mason, representative, Electric Tamper & Equipment Co.

Members Nominating committee (five to be elected), Richard Brooke, assistant general manager, C. & O., Richmond, Va.; H. Austil, bridge engineer, M. & O., St. Louis, Mo.; G. P. Palmer, engineer maintenance and construction, B. & O.C.T., Chicago; C. M. McVay, assistant superintendent, N.Y.C. Alliance, Ohio; B. R. Leffler, bridge engineer, N.Y.C., Cleveland, Ohio; F. R. Judd, engineer buildings, I.C., Chicago; L. J. Riegler, assistant engineer, Penna., Pittsburgh, Pa.; L. P. Kimball, engineer buildings, B. & O., Baltimore, Md.; C. F. Ford, supervisor tie and timber department, C.R.I. & P., Chicago, and P. M. Gault, signal engineer, M.P., St. Louis, Mo.

In addition, J. C. Irwin, valuation engineer, Boston & Albany, Boston, Mass., automatically advances from second vice-president to first vice-president.

Maintenance of Way Club of Chicago

The meeting on December 18, which was designated as Roadmasters' Night, was devoted to an informal discussion of practical track problems in the form of a "Question Box," a considerable number of the 75 members and guests who attended the meeting participating in the discussion. At the next meeting, which will be held on Wednesday evening, January 22, H. S. Clarke, engineer maintenance of way of the Delaware & Hudson, will address the club on the experience that his road has encountered with track in which the rails have been butt-welded.

American Railway Engineering Association

With the report of 10 of the committees in the hands of the secretary in complete form, the first bulletin of committee reports will soon be ready for mailing to the members. Among other reports, this bulletin will contain those of the committees on Signals and Interlockings, Uniform General Contract Forms, Shops and Locomotive Terminals, Economics of Bridges and Trestles, Complete Roadway and Track Structure, and Stresses in Track.

Three committees held meetings early in December for the purpose of making final alterations in the reports of subcommittees, namely, the Committee on Water Service, Fire Protection and Sanitation, which met in New York on December 6; the Committee on Economics of Railway Operation, at Chicago on December 5, and the Special Committee on Waterproofing of Railway Structures, at Chicago on December 5 and 6.

As a result of an amendment to the constitution adopted by letter ballot and announced at the convention last March, and which became effective on January 1, the association will remit the dues of all members who have paid dues for 35 years and of all members who have attained the age of 70 years and have paid dues for 25 years. The secretary has written a letter to members who are eligible to enjoy the benefits of this amendment, notifying them that they will no longer be required to pay dues.

Concurrent with a meeting with the Board of Directors at Washington, D.C., on December 5, the Nominating committee met at the same place for the purpose of selecting the names to go on the ballot to be mailed to the members within the next few weeks. These nominees are:

President, A. R. Wilson, engineer bridges and buildings, Eastern region, Penna., Philadelphia, Pa.

Second vice-president, F. E. Morrow, chief engineer, C. & W. I., Chicago.

Secretary, E. H. Fritch (re-elected).

Treasurer, A. F. Blaess, chief engineer, I.C., Chicago.

Directors (three to be elected), H. R. Clarke, engineer maintenance of way, C.B.

& Q., Chicago; W. G. Arn, assistant engineer, I.C., Chicago; William Michel, chief engineer, Engineering Advisory committee on Way and Structures, Van Sweringen Lines, Cleveland, Ohio; F. P. Turner, principal assistant engineer, N. & W., Roanoke, Va.; F. L. C. Bond, general superintendent, Central region, C.N.R., Montreal, Que.; W. M. Post, assistant chief signal engineer, Penna., Philadelphia, Pa.; C. W. Baldridge, assistant engineer, A.T. & S.F., Chicago, W. H. Penfield, chief engineer, C.M.St.P. & P., Chicago, and J. B. Hunley, engineer bridges and structures, C.C.C. & S.t.L., Cincinnati, Ohio.

Railway Tie Association

In accordance with recent action by the executive committee, President E. J. Stocking has appointed a committee to consider the advisability of revising the constitution to make the association more of a trade association than the technical organization that it has been in the past.

A. S. Fathman has resigned as secretary and I. C. Rowe has been appointed to succeed him, with office in the Railway Exchange building, St. Louis, Mo.

E. A. Morse, vice-president, Potosi Tie & Lumber Company, has been appointed chairman of the Program committee for the next annual convention which will be held in St. Louis on May 15-17.

Pelley Asks Equal Opportunity for Railroads

Equality of opportunity for the railroads was asked by J. J. Pelley, president of the Association of American Railroads in a letter which he addressed recently to "those whose interest in railroads is more than casual." In his leter Mr. Pelley first discussed the improved status of the railroads resulting from increased efficiency, pointing out in this connection that between July and September, 1935, an increase of less than $32,000,000, or about 11 per cent, in gross revenues, represented the difference between a deficit of $16,000,000 in July and a profit, after all charges, of $13,500,000 in September. However, he continued, "regardless of the degree of efficiency which may be achieved by the railroads they will not be able by themselves to solve the so-called 'railroad problem'." Continuing along this line he called attention to the existence of "two contradictory public policies," one applying to the railroads and the other to public transportation by highway, waterway and airway, and said in part: "That railroads have been able to stay in business at all under such unequal conditions of competition, and to do the major transportation work of America, is due to the inherent superiority of the rail method of hauling, which alone can combine in one co-ordinated continent-wide operation the flexibility of the single care with the economy of mass transportation in long trains. The great need of railroads today is more business. As the total commerce of the country may increase with national recovery, the railroads will secure the needed volume if given equality of treatment."

Personal Mention

General

W. D. Supplee, division engineer on the Philadelphia Terminal division of the Pennsylvania, has been promoted to superintendent of the Logansport division, with headquarters at Logansport, Ind. Mr. Supplee was born at Philadelphia and was educated in civil engineering at the University of Pennsylvania, graduating in 1913. Two years later he entered the service of the Pennsylvania as a chanman on the Philadelphia Terminal division, being advanced successively through the positions of rodman, transitman and assistant supervisor. Mr. Supplee was further promoted to supervisor in 1926, and served in this position at Pittsburgh, Pa., Washington, D. C., and on the New York division. On November 16, 1928, he was advanced to division engineer and served in this capacity at Logansport, Buffalo, N.Y., and Philadelphia, being located at the latter point at the time of his recent appointment as superintendent.

Walter S. Higgins, division engineer of the Victoria division of the Texas & New Orleans (Southern Pacific Lines in Texas & Louisiana), who has been appointed superintendent of the same division, as noted in the December issue, was born on September 15, 1884, near Bastrop, Tex. Mr. Higgins graduated from the Texas Agricultural & Mechanical College in 1907 with the degre of bachelor of science in civil engineering, and entered railway service shortly after his graduation as a chainman in the engineering department of the Gulf, Colorado & Santa Fe, at Beaumont, Tex. In August, 1908, Mr. Higgins went with the San Antonio & Aransas Pass (now part of the T. & N.O.), serving with this company as a rodman at Yoakum, Tex., until 1909, when he went with the Galveston, Harrisburg & San Antonio (now also part of the T. & N.O.), as an estimator-draftsman at Victoria, Tex. In June, 1912, he was advanced to roadmaster, being further promoted to division engineer in October, 1916. He was holding the latter position at the time of his recent promotion to superintendent, effective December 1. Since 1909, Mr. Higgins has been located at Victoria.

F. L. Burton, roadmaster of the Radford division of the Norfolk & Western, with headquarters at Roanoke, Va., has been appointed assistant superintendent in charge of maintenance of way of the Pocahontas division, with headquarters at Bluefield, W. Va., to succeed **J. R. Derrick,** who has been promoted to assistant to the general manager, with headquarters at Roanoke, replacing **W. R. Dawson,** who retired effective January 1.

Mr. Burton was born on March 3, 1891, in Pulaski County, Va., and entered the service of the Norfolk & Western on October 17, 1912, as a chainman in the engineering department, then serving successively as a rodman, transitman, inspector, assistant roadmaster and roadmaster. He was holding the latter position on the Radford division at the time of his promotion to assistant superintendent in charge of maintenance of way of the Pocahontas division.

Mr. Derrick was born on March 15, 1885, at Paces, Va., and entered the service of the Norfolk & Western on March 19, 1906, as a chainman in the engineering department. He was then advanced successively through the positions of rodman, inspector, transitman, assistant resident engineer, assistant roadmaster, assistant trainmaster and assistant superintendent, holding the latter position on the Pocahontas division at the time of his recent appointment.

Mr. Dawson was born on April 21, 1870, at Tazewell, Va., and entered the service of the Norfolk & Western 46 years ago as a bridge carpenter on the Pocahontas division. He was promoted to bridge foreman in January, 1893, and thence to master carpenter three years later. In August, 1905, Mr. Dawson was further promoted to general supercisor of maintenance of way and structures, being appointed assistant superintendent of the Pocahontas division in April, 1907. He was appointed assistant to the general manager in February, 1915.

Engineering

E. O. Wood, division engineer on the Pennsylvania, with headquarters at Indianapolis, Ind., has been appointed also engineer, maintenance of way of the Indianapolis Union, succeeding **T. R. Ratcliff.**

W. L. Fisher has been appointed assistant engineer on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Mattoon, Ill., to succeed **E. M. Roberts,** whose appointment as assistant bridge and building supervisor is noted elsewhere in these columns.

John L. Gressitt, general superintendent of the Northwestern division of the Pennsylvania, with headquarters at Chicago, has been appointed acting chief engineer maintenance of way of the Western region, with the same headquarters, succeeding **Porter Allen,** who has been granted a leave of absence because of ill health.

H. F. Fifield, engineer maintenance of way of the Boston & Maine, has been appointed also engineer maintenance of way of the Maine Central reporting to the chief engineer with headquarters as before at Boston, Mass. Mr. Fifield succeeds **C. S. Robinson,** who has been appointed to the ewly-created position of assistant engineer maintenance of way of the Maine Central and Boston & Maine, with headquarters at Portland, Me.

C. T. Dike, vice-president and chief engineer of the Chicago & North Western, with headquarters at Chicago, has been appointed also to the same position on the Chicago, St. Paul, Minneapolis & Omaha, following the death, as noted elsewhere in these columns, of **Harry E. Barlow,** chief engineer of the Omaha. **C.**

E. Hise, assistant engineer on the Northern Iowa and Sioux City divisions of the Chicago & North Western, with headquarters at Sioux City, Iowa, has been appointed to the newly-created position of principal assistant engineer of the Omaha, with headquarters at St. Paul, Minn. **D. K. van Ingen,** supervisor of bridges and buildings on the North Western, with headquarters at Mason City, Iowa, has been appointed assistant engineer at Sioux City, to succeed **Mr. Hise. H. L. Barr,** roadmaster on the North Western at Boone, Iowa, has been appointed assistant engineer at Huron, S. D., to succeed **S. S. Long,** whose appointment as engineer and supervisor of bridges and buildings at Mason City, Iowa, is noted elsewhere in these columns.

B. R. Kulp, principal assistant engineer of the Chicago & North Western, effective January 1, was appointed engineer maintenance of way, with headquarters as before at Chicago, succeeding **J. A. Peabody,** who retired on that date at his own request because of health. **Don C. Barrett,** supervisor of bridges and buildings of the Madison division, with headquarters at Winona, Minn., has been promoted to division engineer of the Black Hills division, with headquarters at Chadron, Nebr., effective January 1, replacing **C. H. Wells,** who has been transferred to the Iowa division, with headquarters at Boone, Iowa, replacing **M. E. Thomas,** who has retired under the pension rules of the company.

Mr. Kulp has been in the service of the North Western for 30 years. He

B. R. Kulp

was born at Duncannon, Pa., on December 16, 1883, and attended the public schools at Harrisburg, Pa. After graduating from Rensselaer Polytechnic Institute in 1905, he obtained his first railroad experience as an instrumentman on the Galena division of the North Western. Later he was advanced to draftsman and to assistant engineer of maintenance on that division, and in 1909 he was transferred to the terminal improvements at Clinton, Ia. During 1910 and 1911 he served as assistant engineer on the yard improvements at Proviso, Ill., and in 1912 he was promoted to division engineer of the Ashland division at Antigo, Wis. Mr. Kulp was appointed trainmaster on the Southern Illinois division at Benld, Ill., in 1917, where he remained until 1918, when he was transferred to the Galena division at Chicago. In 1920 he returned to the engineering department as division engineer of the Madison division, where he remained until May 1, 1931, when he was promoted to principal assistant engineer, the position he was holding at the time of his recent appointment as engineer maintenance of way.

Mr. Peabody has been connected with the North Western for 37 years, 28 of which have been as signal engineer. He was born on February 5, 1870, at Chicago and commenced his railway career in June, 1888, as a rodman and instrumentman on the Baltimore & Ohio at Zanesville, Ohio. In 1892, Mr. Peabody was appointed instrumentman on location, with headquarters at Pittsburgh, Pa., and in 1894, he left railway service to become chief draftsman of the Paige Iron Works, Chicago. In 1898, he returned to railway service as a roadmaster on the Chicago & North Western, in which position

J. A. Peabody

he served successively at Tracy, Minn., Ashland, Wis., and Milwaukee. In 1902, he was promoted to signal engineer with headquarters at Chicago, which position he held until 1931, when he was appointed engineer maintenance of way. Mr. Peabody served the Railway Signal Association, now the Signal Section, A.A.R., as president in 1907.

C. D. Merrill, supervisor on the Philadelphia Terminal division of the Pennsylvania has been promoted to division engineer in the office of the vice-president in charge of traffic, with headquarters at Philadelphia, Pa., to succeed **R. W. Sheffer,** who has been transferred to the Middle division. Mr. Sheffer replaces **S. Danby,** who has been transferred to the Baltimore division, where he relieves **J. M. Fox,** who has been transferred as division engineer to the office of the chief electrical engineer, at Philadelphia.

H. L. Bell, trainsmaster of the Victoria division of the Texas & New Orleans (Southern Pacific Lines in Texas and Louisiana), who has been appointed division engineer of the same division, as noted in the December issue, was born on July 21, 1894, at Edmond, Okla. Mr. Bell received his education at the Central Teachers College of Oklahoma and the Rice Institute at Houston, Tex. After leaving school in 1919, he entered the service of the Southern Pacific as an engineer in the valuation department, being made assistant engineer in June, 1920. In September of the following year

H. L. Bell

Mr. Bell was promoted to roadmaster and in January, 1924, he was further advanced to division engineer. Four years later Mr. Bell was promoted to assistant superintendent and in April, 1933, he was made trainmaster, which position he was holding at the time of his recent appointment.

Track

E. A. White, assistant roadmaster on the Chicago & North Western, with headquarters at West Chicago, has been promoted to roadmaster, with headquarters at Wall Lake, Iowa, to succeed **H. A. Halverson,** who has been transferred to Boone, Iowa, to replace **H. L. Barr,** whose appointment as assistant engineer is noted elsewhere in these columns.

S. J. Hale, resident engineer on the construction of the Buchanan branch of the Norfolk & Western in Buchanan county, Va., has been appointed roadmaster of the Radford division, with headquarters at Roanoke, Va., succeeding **F. L. Burton,** whose appointment as assistant superintendent in charge of maintenance of way on the Pocahontas division is noted elsewhere in these columns. Mr. Hale was born on October 29, 1887, in Wayne County, W. Va., and entered the service of the Norfolk & Western on December 6, 1906, as an axeman in the engineering department on surveys in West Virginia. Since then he has served in various capacities in the engineering department.

B. L. Reid, resident engineer on construction on the Canadian Pacific, has been promoted to roadmaster, with headquarters at Outlook, Sask., succeeding **E. Willis,** who has been transferred with the same headquarters to **replace T. Roulston,** who has been sent to Regina, Sask., where he succeeds **A. E. Stewart.** Mr. Stewart has been transferred to Cranbrook, B.C., to replace **Charles Fos-**

sett, who has retired on pension because of ill health. **W. G. Dyer,** a transitman with headquarters at Regina, has been promoted to roadmaster, with headquarters at Humboldt, Sask., to succeed **J. C. Jones,** who has been transferred to Regina, succeeding **A. J. Wolfe.** Mr. Wolfe has been transferred to North Bend, B. C., where he replaces **T. J. Behan,** whose appointment as bridge and building master is noted elsewhere in these columns. All these changes became effective on January 1.

M. S. Smith, assistant supervisor on the Philadelphia division of the Pennsylvania, has been promoted to supervisor on the Erie & Ashtabula division with headquarters at New Castle, Pa., to succeed **C. R. Uitts,** who has been transferred to the Atlantic division, with headquarters at Camden, N. J. Mr. Uitts succeeds **C. W. Heinze,** who has been transferred to the Middle division, with headquarters at Lewistown, Pa., where he succeeds **G. M. Hain,** who has been transferred to the Philadelphia terminal division. Mr. Hain replaces **C. D. Merrill,** whose promotion to division engineer in the office of the vice-president in charge of traffic is noted elsewhere in these columns. **S. M. Rodgers,** assistant supervisor, with headquarters at Buffalo, N. Y., has been transferred to the Philadelphia division, with headquarters at Downingtown, Pa., to succeed **A. M. Harris,** who has been transferred to the Philadelphia division, with headquarters at Harrisburg, Pa.

J. Levesque, section foreman on the Canadian National at Lairet, Que., has been appointed acting assistant roadmaster on the Cochrane division with headquarters at Taschereau, Que., succeeding **P. Levesque,** who has been promoted to roadmaster with the same headquarters. Mr. Levesque replaces **A. Malo,** who has been transferred to Quebec, Que., to releave **J. P. H. Moore,** who has been transferred to Montreal, Que., suceeding **B. C. Haskins,** retired. **J. A. H. Christie,** roadmaster on the Alberta district, has been transferred to the Regina division of the Saskatechewan district, with headquarters at Radville, Sask., succeeding **A. S. Boulding,** who has been transferred. **W. E. Mellor** has been appointed roadmaster, with headquarters at St. Thomas, Ont., succeeding **William R. Pulford,** who has retired after a total of 51 years of railroad service.

Bridge and Building

E. M. Roberts, assistant engineer on the Cleveland, Cincinnati, Chicago & St. Louis at Mattoon, Ill., has been appointed assistant bridge and building supervisor, with headquarters at Mt. Carmel, Ill.

Jesse B. Teaford, bridge and building supervisor on the Southern at Louisville, Ky., whose retirement was noted in the November issue, was born on April 9, 1867, at Georgetown, Ind. Mr. Teaford entered the service of the Louisville, Evansville & St. Louis (now the Southern) in May, 1886, as a section laborer, being made a bridge carpenter in May, 1889. On January 1, 1892, Mr. Teaford was advanced to bridge and building foreman and on October 1, 1910, he was further promoted to bridge and building supervisor, which position he was holding at the time of his retirement.

S. S. Long, assistant engineer on the Chicago & North Western, with headquarters at Huron, S. D., has been appointed engineer and supervisor of bridges and buildings at Mason City, Iowa, to succeed **D. K. van Ingen,** whose appointment as assistant engineer is noted elsewhere in these columns.

T. J. Behan, roadmaster on the Canadian Pacific, with headquarters at North Bend, B. C., has been appointed bridge and building master of the Vancouver division, with headquarters at Vancouver, B. C., to succeed **D. Swanney,** who retired on December 31, after having reached the age limit.

Obituary

Frank D. Smart, roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Shopton, Iowa, died on November 20, 1935.

Harry E. Barlow, chief engineer of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at St. Paul, Minn., died of heart disease at his home in that city on December 11. Mr. Barlow had been connected with the Omaha continu-

Harry E. Barlow

ously for 32 years. He was born on March 25, 1880, at Baraboo, Wis., and was educated in civil engineering at the University of Minnesota. Mr. Barlow entered the service of the Omaha in 1903 as an assistant engineer in which capacity he remained until 1920, when he was promoted to chief engineer, the position he was holding at the time of his death.

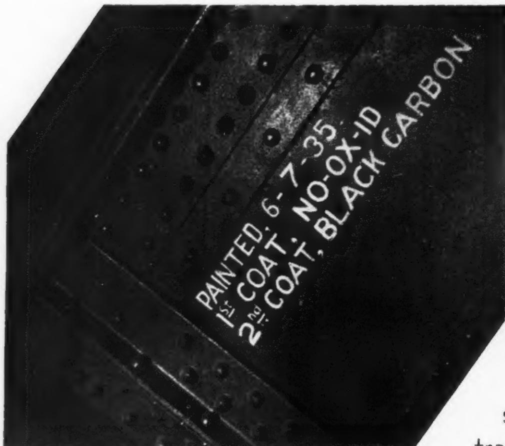
Charles H. Ewing, president of the Reading and of the Central of New Jersey, and an engineer by training and experience, died of pneumonia on December 8 at his home in Melrose Park, Pa. Mr. Ewing was born on May 28, 1866, at Pottstown, Pa., and was educated in civil engineering by private tutoring. He entered railway service on August 1, 1883, as a rodman with the Philadelphia & Reading (now the Reading), serving subsequently as an assistant engineer and supervisor. On November 1, 1892, Mr. Ewing became connected with the Central New England (now part of the New York, New Haven & Hartford), with which company he remained in the positions of division engineer and chief engineer for nearly 10 years before returning to the Philadelphia & Reading on August 1, 1902. After serving as division engineer until June 1, 1905, he was ap-

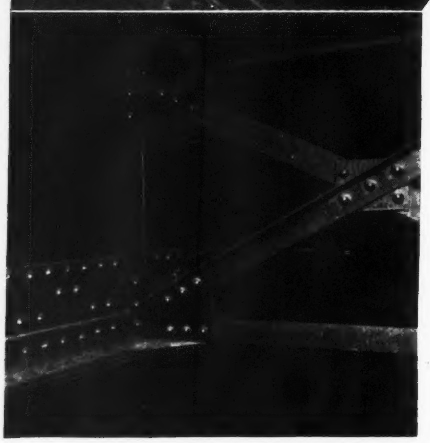
Charles H. Ewing

pointed engineer maintenance of way, which position he held until October 15, 1910, when he was appointed superintendent of the Atlantic City Railroad, being further promoted to general superintendent of the Philadelphia & Reading on January 1, 1913. In 1916, Mr. Ewing was appointed general manager and on December 1, 1917, he was further advanced to vice-president in charge of operation and maintenance. Except for the war period, when he served as federal manager of the Philadelphia & Reading, the Central of New Jersey and the Staten Island Rapid Transit, Mr. Ewing continued as vice-president of the J. & R. and its successor the present Reading Company until his election to the presidency in 1932. In the following year he was elected also president of the Central of New Jersey.

Facts About Built-Up Roofs—Johns-Manville, New York, has recently published a 22-page illustrated brochure, in which are discussed the economies, serviceability and installation of built-up roofs. The brochure contains many photographs showing examples of built-up roofs and their application, as well as drawings illustrating the proper methods of applying built-up roofs.

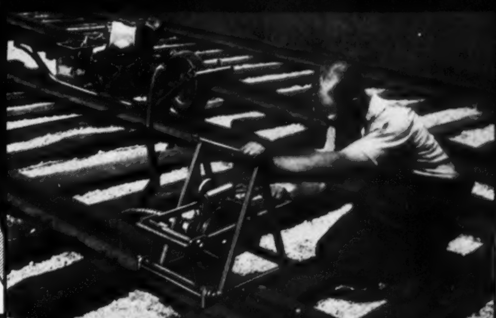
Republic Wire Nails and Wire Products—The Republic Steel Corporation, Chicago, has issued a 40-page illustrated booklet bearing this title, in which up-to-date information is given concerning Republic wire, wire nails and fence posts. This booklet, which is known as Form ADV.226-B, is fully indexed and considerable space is devoted to tables of sizes, gages and the number of units per pound for nails, designated for various ordinary and special uses.





ALPHABETICAL INDEX TO ADVERTISERS

Wherever Rail Grinding is Done



Slotting joints with guide gives greater accuracy and speed.

Cup wheel removing flow at switch points and stock rails.

One of the many jobs to be done with freely held wheel.

Precision Grinder

This new grinder is the latest contribution of Nordberg to track maintenance. Its cup wheel not only cuts fast but attains a precision equivalent to tool room grinding. The design is one that affords the essentials of speed, accuracy and ease to the operator, not found in any other rail grinder. For finish grinding after welding, or for removing mill tolerance, it meets today's demands for better track for high speed traffic.

Utility Grinder

There are so many uses to which this grinder can be put, and with the various attachments developed by Nordberg, it is truly an all-purpose grinder. Slotting joints, grinding switches, frogs and crossings and boring holes for screw spikes, are only some of its uses. Here is a tool that can be kept busy throughout the year, saving money and doing each job better.

THE OTHER NORDBERG TRACK TOOLS

Adzing Machine	**Track Wrench**
Spike Puller	**Power Jack**
Rail Drill	**Track Shifter**

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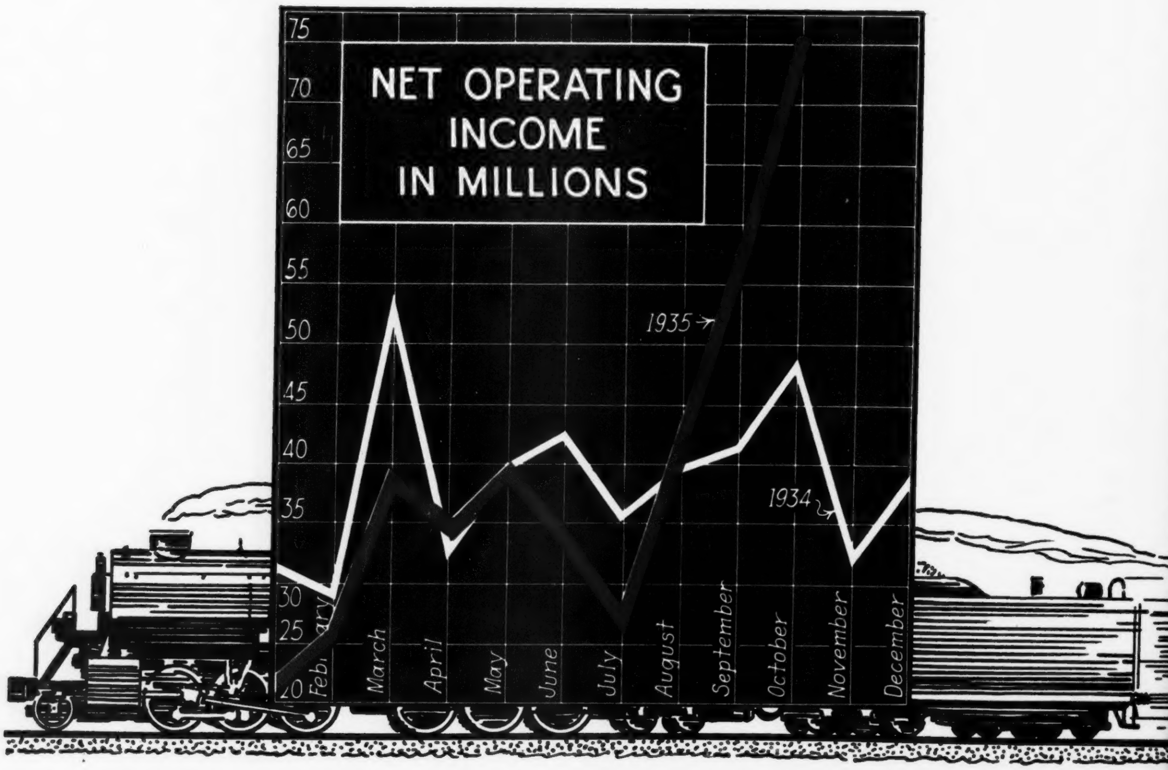
TO RAILWAY SUPPLY MANUFACTURERS

Railway Purchases Follow Railway Earnings



When net railway operating income rises, purchases also start upward

In the first seven months of 1935, net operating income *declined* $40,644,235.

But in October, it *increased* $26,088,785, or 55 per cent.

And for November, early returns indicate an *increase* of 60 per cent.

While in December carloadings were at the highest level for five years.

And all indications point to still further acceleration in the new year.

The needs of the railways are great.

The increase in earnings is increasing their ability to buy.

Programs for 1936 are in the making.

Are you including in your sales plans a schedule in Railway Engineering and Maintenance that will keep your products throughout 1936 before those railway officers who will carry out these programs and select the materials and equipment therefor?

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS